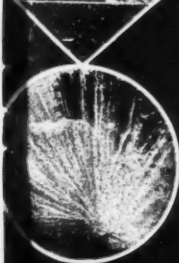
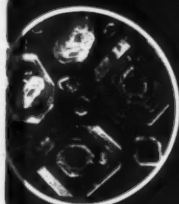


CHEMISTRY



New Chemical Roads to Cortisone.....	1
Cortisone Medical Conquests.....	6
Chemical Savers of Life.....	9
New Living Processes Theory.....	11
Hydrogen Bomb Dialog.....	13
Sun Energy from Protons?.....	14
Anti-Proton Fundamental Particle.....	15
World Chemical Conclave.....	17
Understanding Chemical Changes.....	19
Inert Gases Form Strange Substances.....	21
Back Cover Picture: Clathrate Crystals.....	21
New Cotton Dissolves in Water.....	23
Heart, Artery and Blood Chemistry.....	25
Vitamins to Fight Alcohol.....	31
Antibiotic and Vitamin Spurt Growth.....	32
Ideas of Interest to Chemists.....	37
For the Home Lab: Sulfur Dioxide.....	42
Lower-Cost Titanium Metal.....	45
Solid Plastics Made from Liquid.....	46
Enriched Rice Saves Lives.....	47
Proudly Presented.....	48

Editorial:

The Cortisone Story

Inside Front Cover

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The Cortisone Story

It seems longer ago than a little over two years when a bed-ridden sufferer from arthritis arose and danced a jig after treatment with small amounts of an adrenal cortical hormone, isolated by Dr. Edward C. Kendall of the Mayo Clinic and clinically pioneered by a Mayo Clinic group headed by Dr. Philip S. Hench. This substance was cortisone.

In the months since, it has been shown to be a veritable wonder drug. There have been the inevitable failures and dangers, it is true. But the list of ills and disorders in which cortisone, and its therapeutic running mate, ACTH, have proved helpful is long indeed. It has even been considered a potential fountain of youth for aging people and a defense against chronic diseases additional to arthritis, rheumatism, rheumatic fever, gout, etc. As the supply of the drug increased, it has been tried on many kinds of medical conditions.

As production has been pushed vigorously with ox bile as the raw material, there has been a many faceted search for new ways of making this complex chemical and new materials from which to make it.

The latest chapters in this exciting story are told in this issue of **CHEMISTRY**. The chemistry is complex. The syntheses are far from final in their details. There will be other raw materials found and used. But the conquest of the cortisone situation is assured. Chemistry provides the material for more medical advances.

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► From the Mexican yam carried by this boy comes a substance that can be made into the anti-arthritis hormone, cortisone.

New Chemical Roads to Cortisone

► INTENSIVE research by numerous teams of chemists in progress here and abroad since the discovery of the therapeutic usefulness of cortisone in April 1949 has culminated in a series of announcements of new routes to this important hormonal drug. It has been manufactured by a lengthy synthesis from a constituent of cattle bile, available in only limited quantity as a by-product of the stockyards.

Other useful hormonal drugs, particularly the female sex hormones estrone and progesterone, the male

sex hormone testosterone, and the adrenal cortical hormone DOCA, are being manufactured in fully adequate amounts from the abundantly available animal material cholesterol, and, more efficiently, from diosgenin, extracted from special Mexican dioscorea.

The difficulty encountered in the production of cortisone is that this substance carries an oxygen atom in an inaccessible part of the molecule, at position 11.

Three solutions seemed possible. One was to find some way of introducing oxygen at position 11 into one of the abundantly available natural steroids: cholesterol (spinal cord of cattle), diosgenin (Mexican discorea), ergosterol (yeast), or stigmasterol (soy bean). Another was to produce by total synthesis from cheap non-sterol starting materials a synthetic steroid capable of being oxygenated at position 11. A third was to discover and cultivate a plant that produces the very rare heart-poison principle sarmentogenin, which already carries oxygen at position 11.

The May 1951 issue of the *Journal of the American Chemical Society* contained three papers reporting substantial progress. Prof. Louis F. Fieser of Harvard University, with his students Josef E. Herz and Wei-Yuan Huang, reported a first method for introducing an 11-oxygen atom into available natural steroids by a process of oxidation of an intermediate of a "di-ene" type (two ene groups, or two double bonds). A parallel paper dated only one day later reported discovery of a second process of oxidation of the same "di-ene" intermediates by a team of eight chemists of the Merck and Co. Laboratories headed by Dr. Max Tishler.

The third May paper, by Prof. Robert B. Woodward of Harvard and his associates Drs. Franz Sondheimer, David Taub, Karl Heusler, and W. M. MacLamore, reported achievement of the total synthesis from simple starting materials of a steroid offering potentialities for utilization as an intermediate to cortisone. "The first total synthesis of a complete steroid" chemical was their accomplishment.

Steroids are a group of chemicals that include sex hormones, cortisone, bile acids which are the starting material for cortisone, some cancer-causing substances and the non-starch part of some plant chemicals such as the heart medicine, digitalis.

The chemical Prof. Woodward has made in his laboratory is not cortisone. It is not the related anti-arthritis chemical, compound F. Opinions are divided on whether it can be used as the starting point for synthesizing compound F or cortisone through a process by-passing the bile acids.

The practical value of the new synthetic chemical remains for the future to tell. The processes for converting one steroid chemical into another are so well worked out that the synthesis of natural steroids may be accomplished in the near future. Natural steroids are the ones found in plants and produced by certain glands such as the adrenal glands that produce cortisone. Prof. Woodward's synthesis of a steroid starts with a simple coal tar derivative, orthotoluidine.

The *Journal of the American Chemical Society* for July 1951 contained a report of further advance from Mexico City. Syntex S.A. reported a third process of oxidation of sterol "di-enes" for production of intermediates with oxygen at position 11, a practical method of making the anti-arthritis hormone, cortisone, from a wild Mexican root, instead of ox bile as now necessary. This promises to make this wonder drug more plentiful in the future.

The new synthesis was worked out in Mexico by a chemical team of the Syntex Research Laboratories, American branch of which is Chemical

Specialties Co., Inc., New York. It requires 22 steps, but it will be used in an industrial plant in Mexico to be in production early in 1952.

The starting point of the Syntex synthesis is a common tropical yam, known as dioscorea or cabeza de negra (black head), which has been the starting point for Syntex production of other hormones such as testosterone, estradiol, progesterone and pregnenolone.

Two years ago the Mexican chemists began an intensive attempt to start with the yam and come out with cortisone. A three-stage attack brought success, through a combination of research in their own and other laboratories. The principal scientists of Syntex were Dr. George Rosenkranz, and Dr. Carl Djerassi, with Dr. Gilbert Stork of Harvard as consultant.

The July issue of the *Journal of the American Chemical Society* tells how cabeza extract is converted into a complex substance known as 11-keto-allo-pregnanolone. Previously in the same journal the conversion of this substance into Reichstein's Compound D was reported, and in the July 7 issue of the British journal *Nature* a relatively simple three-step procedure for transforming this compound into cortisone was detailed.

Thus a synthesis of cortisone has been developed that begins with yam roots that even now are being processed at the rate of 500 tons a month.

Dr. I. V. Sollins of Chemical Specialties Co., New York, explained that Syntex chemists expect to be able to eliminate in the future five or six of the 22 steps in the process.

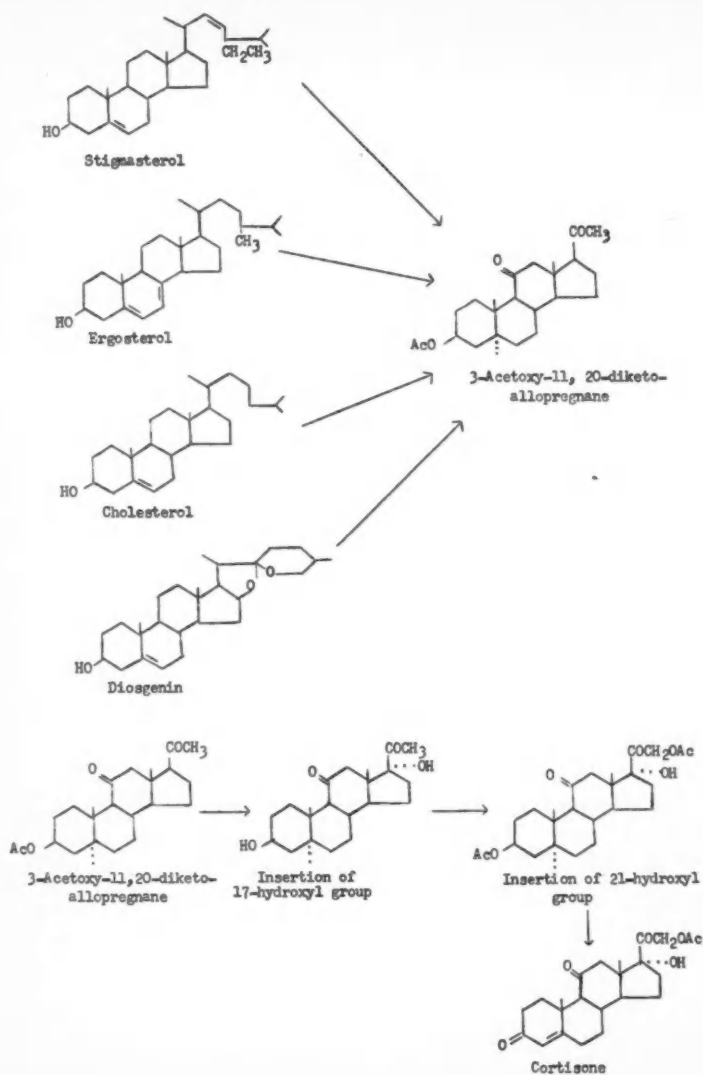
The total synthesis of cortisone in

60 steps, as a chemical process that will not be applied practically, was also announced. The research of other scientists, notably Sir Robert Robinson of England and Prof. Robert B. Woodward of Harvard, were applied in working out this total synthesis.

While the inedible yam dioscorea grows wild, it was placed under cultivation two years ago when it proved to be valuable as a raw material for drug synthesis. It is now being grown in Puerto Rico as well as Mexico to assure a continuing supply, not only for cortisone production but for other hormones as well.

A fourth more efficient process for oxygen at position 11 is reported in the August 1951 *Journal of the American Chemical Society* by Dr. Fieser and coworkers, John C. Babcock, Josef E. Herz, Wei-Yuan Huang, and William P. Schneider.

The introduction of the all-important 11 oxygen atom into another class of substances, hitherto derivable only from natural bile acids, had also been studied by the Fieser group. In May, 1950, Drs. Fieser, Hans Heymann and S. Rajagopalan had announced the development of this method, and its application to a particular member of the bile acid series. In the August 1951 issue of the *Journal of the American Chemical Society* Drs. Heymann and Fieser report the extension of this method to a second member of the bile acid series. The product of these reactions was a substance that had already been transformed into cortisone in a series of steps worked out in the period 1944-1949 by T. Reichstein in Switzerland, E. C. Kendall of the Mayo



Clinic, and L. H. Sarett of Merck and Co.

In a parallel communication in the August 1951 *Journal of the American Chemical Society* Dr. Woodward, who in July had reported conversion of his "total synthesis" steroid into intermediates already correlated with the various sex hormones and with cholesterol, described, with his associates Drs. Sondheimer and Taub, three further transformations of the synthetic steroid. These new steps led to that substance of the bile acid series to which Drs. Heymann and Fieser recently had applied their method for the introduction of the 11 oxygen atom, and thus completed the final links between a steroid made from simple starting materials and a series of chemical reactions known to produce cortisone.

In the opinion of the Harvard group, it remains for research-development teams to determine what overall efficiency can be achieved in the 30 total-synthesis steps, the four steps for oxygenation, and the following 14 steps to cortisone. Evaluative work of this type will require a great deal of time and effort and it should be emphasized that the commercial production of cortisone by total synthesis is a long way off. Certainly, no one is going to be treated medically for some time to come with cortisone prepared from simple starting materials. Even the processes for oxygenating natural sterols will require evaluation for establishing that available chemical methods are applicable to the specific intermediates now at hand, but it does seem clear that the previous barrier to utilization of

natural sterols for cortisone production has been broken down.

Merck chemists have reported parallel research. Final steps of the transformation into cortisone of four substances plentiful in nature are reported in the August 1951 issue of the *Journal of the American Chemical Society* by a group of chemists of Merck & Co., Inc., consisting of Drs. John M. Chemerda, group leader, E. M. Chamberlain, E. H. Wilson and Max Tishler, associate director of research and development at Merck.

This marks success in the search by Merck for a new synthesis of cortisone from raw materials more plentiful than cattle bile. Solution of the most difficult problem in this search was reported in the May 1951 *Journal of the American Chemical Society*.

The achievement announced in May consisted in the transformation of four steroids — ergosterol (a product of yeast metabolism), diosgenin (extracted from a Mexican yam), stigmasterol (from soy beans), and cholesterol (from the spinal columns of cattle and from wool fat) — into the 11-oxygenated steroid, 3-acetoxy-11, 20-diketo allopregnane.

These four steroids do not have functional groups, such as oxygen, in ring C of the steroid nucleus, as does the bile acid compound from which cortisone has been synthesized previously. The discovery of a practical method of oxygenating position eleven of these initially barren steroids unlocked a veritably inexhaustible natural storehouse of raw materials for future production of cortisone.

The Merck chemists have reported in the August *Journal of the American Chemical Society* the culminating steps in their synthesis. In this phase the problem was to manipulate the side chain or tail of the steroid and introduce still other functional groups at positions seventeen and twenty-one of the molecule. These were hydroxyl groups represented by chemists as OH groups. Finally, positions four and five were each stripped of one hydrogen atom and the essential double bond was created at these positions. Thus the final transformation to cortisone was completed.

Now that the synthesis of cortisone from these more abundant steroids has been accomplished, the availability of larger quantities of cortisone for the future is assured. It was recognized by Merck, as soon as the clinical value of cortisone in rheumatoid arthritis was established, that the bile process alone could not supply the potential demands for cortisone.

However, the recent achievement of converting such steroids to cortisone does not mean that cortisone

supplies will quickly become plentiful, nor does it mean that the chemists' work is done. Before large scale production from new raw materials can begin, the process has to be improved, the supply of these steroids has to be assured, and additional facilities must be built. Moreover, the procurement of new equipment under present circumstances is slow and difficult. Development studies by chemists and engineers are under way to make the process practical and to adapt it to large-scale production equipment.

The Merck brand of cortisone, Cortone will continue to be manufactured from the currently used raw materials until production from the new materials has been sufficiently developed to supply the full demand. The production of cortisone by Merck is continuing at an increasing rate, with improvements in manufacturing efficiency being made constantly. A new Merck production unit in Danville, Pa., is expected to be in full operation by the middle of 1952.

Cortisone Medical Conquests

► WHILE cortisone has proved of greatest use in the treatment of arthritis, reports of other medical uses are being made week by week. Some of them are detailed below.

Prevents Liver Cancer

► FIRST evidence that the adrenal gland cortex, famous for production of cortisone, may play an important role in liver cancer has been obtained by Drs. Alexander Symeonidis, Ambadas S. Mulay and F. H. Burgoyne at the U. S. National Cancer Institute.

Rats can be kept from getting experimental liver cancer by a chemical relative of cortisone, desoxycorticosterone.

Rats were fed a semi-synthetic diet containing butter yel'ow. This cancer-causing dye chemical has nothing to do with butter, but gets its name from its color. Half the animals that lived six months on this diet developed liver cancer. But when animals on the same diet were given shots of the cortical hormone, the oc-

currence of cancers was drastically reduced.

The fact that the adrenal gland influences the function of liver cells and the regeneration of damaged livers has been known previously, but not the connection with liver cancer.

For Swelling of Throat

► A NEW, potentially life-saving use, for cortisone has been made by Dr. Joseph Freeman of Mount Sinai Hospital, New York.

Seven patients threatened with suffocation because of swelling of the voice box in the throat were relieved of the dangerous swelling within 24 hours by "full doses" of cortisone.

In two of the patients the swelling followed a course of protracted radiation treatment for cancer of the larynx. In four the condition was due to croup. In the seventh the swelling was due to an abscess that formed after a foreign body got in his throat. This patient had been given antibiotics for 36 hours previously without effect.

Helps Pregnancy Toxemia

► EXPECTANT mothers who develop dangerous toxemia of pregnancy may be helped by cortisone. Eight cases were treated at the National Maternity Hospital in Dublin. All the patients were seriously ill, with high blood pressure, headaches, and disturbed kidney function. Some had had convulsions. In all cases the patients improved considerably within a few days after the treatment was started.

Headache was relieved, the women no longer needed sedatives except occasionally at night. They felt better, ate better, their eyes improved. Drop-

sy swellings of ankles, feet and the like were reduced, though some later developed dropsy of the abdomen, medically termed ascites. Kidney function improved, but blood pressure was not significantly affected.

All but one of the mothers gave birth to live babies. In three cases, cortisone enabled the mothers to carry their babies enough longer so that the babies were born alive, though they were premature.

Important advantage of the cortisone treatment was that the mothers did not need so much sedative medicine to control their restlessness and reduce the risk of convulsions. Use of sedatives for this purpose, though otherwise necessary, carries a definite risk to the baby.

Doctors reporting the cases were: Henry Moore, W. J. E. Jessop, D. K. O'Donovan, A. P. Barry, Brigid Quinn and M. I. Drury. Details of the cases appeared in the British Medical Journal.

Delays Liver Damage

► CORTISONE can help delay liver degeneration due to faulty diet, Dr. Klaus Schwarz, special research fellow of the U. S. Public Health Service, discovered.

Dr. Schwarz' studies were made on rats who got their starch and sugar chemistry upset by feeding them a diet that was almost one-third yeast. This caused severe damage to their livers.

The liver damage was very like that seen in humans suffering from the almost always fatal disease, acute yellow atrophy of the liver. This suggests that cortisone might help human patients with this particular

liver disease. Dr. Schwarz has not yet been able to make trials of this.

European scientists, however, have used another hormone from the adrenal glands which produce cortisone to treat epidemic hepatitis. This is the liver disease that is believed caused by a virus and sometimes called jaundice, because of the yellow skin color it gives. The European doctors claim that the adrenal gland hormone helped in this disease.

Saves Sight of Children

➤ ANOTHER disease has yielded to cortisone. It will save the sight of thousands of children who might otherwise become blind.

The disease has a name that's a layman's nightmare: phlyctenular keratoconjunctivitis. It occurs in people with tuberculosis, particularly children, causing corneal scarring and frequent blindness.

Two doctors have found that they can clear up the disease and hold it in check simply by applying a solution containing cortisone with an eyedropper, four times a day.

This appears to be the first really effective method of combatting the disease, according to a report in the American Journal of Ophthalmology, by Dr. Phillips Thygeson, of the University of California School of Medicine, and Dr. Milo H. Fritz, U. S. Public Health Service consultant at Anchorage, Alaska.

Rapid healing, usually within 48 hours, occurred in all 26 patients treated. Only two recurrences occurred, and these were quickly quelled by new treatments. Only small quantities were needed, so cost was not a major factor.

While most of the treatment was administered with an eyedropper, some patients received injections under the membrane that lines the eyeballs. The scientists said that even in the most serious cases it does not appear to be necessary to inject it into the body so that it affects the whole system. Thus adverse reactions which sometimes result from such injections are avoided.

The physicians pointed out that cortisone does not cure the disease, which can recur so long as the individual has tuberculosis. However, it seems able to clear it up at any time and hold it in check.

The treatment will be especially useful in Alaska, where the tuberculosis rate among the Indians and Eskimos is high and there is little protection of the children from it. The physicians treated patients in both the Alaska and the San Francisco areas.

The disease is believed to be caused by an allergic reaction to products thrown off by the tubercle bacillus.

For Chronic Berylliosis

➤ A NEW disease, a result of our increasingly complex industrial life, has been retarded by the new drugs ACTH and cortisone. A pulmonary chest disease, it is called chronic berylliosis.

It attacks the lungs and occasionally other parts of the body. Small amounts of beryllium, a metal now being used in copper and other alloys, sometimes get into the bodies of workers and others who have contact with it, causing the disease.

The new treatment was reported by Dr. H. E. Tebrock of Sylvania Electric Products, Inc.

**Since Sulfa Drugs, Introduced in 1936,
Many New Products Have Transformed Medicine**

Chemical Savers of Life

From the Industrial Bulletin of A. D. Little, Inc., for July 1951.

➤ SINCE the sulfonamides were introduced in 1936, wave after wave of medical advances have transformed the pharmaceutical industry. There is still no end in sight; many fields have been conquered, but many more remain. The medical profession has become attuned to quick acceptance of proved new products; some new classes of drugs have reached sales of \$100 million in a year or two, and sales of old products usually do not decline proportionately. Competition in research and development has reached a new peak. Like the automobile makers, the pharmaceutical companies must continually turn out new models, but in medicine the new models must, and usually do, represent life-saving advances.

The sulfa drugs are still important, with over \$20 million worth sold in 1949, and are widely used in combination with penicillin, another standby of the industry. Penicillin's low incidence of troublesome side reactions, low price, wide application, and use in animal feeds seem to assure it a place in the list of widely used pharmaceuticals. Although supply exceeded demand in 1949, and production was curtailed somewhat, an 80 per cent increase in production capacity is planned for the near future. Before the Korean conflict started, capacity was for 18,600 billion Oxford units of penicillin per month, or about 300,000 pounds a year, worth over

\$200 million to the pharmaceutical industry. Research on synthesis of penicillin-like materials shows promise of useful results.

Streptomycin, on the other hand, has not shown the same resurgence, though production has edged up to about 220,000 pounds annually, worth \$48 million. Before the Korean conflict, two thirds of U.S. streptomycin was sold overseas, and a decline in exports may occur as facilities abroad get into production.

The new "broad-spectrum" antibiotics, discovered only four years ago, are already of major importance. Aureomycin was introduced commercially in late 1948 and by April, 1950, was selling at an estimated annual rate of \$25 million. Doctors accepted its two competitors, Chloromycetin and Terramycin, with comparable speed. Further increases are expected for this year, with total production valued at perhaps \$170 million for the three. Effectiveness of these broad-spectrum antibiotics overlaps considerably, with results varying for individuals, and they are comparable in their degree of toxic side reactions. Successful synthesis of Chloromycetin, leading to a lower price, may give it the leading position. Still other new antibiotics have been announced, but are not yet commercially important.

The hormone field, stimulated by the dramatic results obtained with cortisone and ACTH, is still far from

fully developed. Although output of cortisone continues to increase, it has been impossible to keep pace with demand. Before cortisone can be made in sufficient quantities, a new starting material, more plentiful than cattle bile, must be found. Continued work with other adrenal secretions shows promise. Two more steps added to the 32-step cortisone synthesis yield compound F, now undergoing clinical evaluation. Recent research suggests that compound F may be the primary secretion of the adrenal cortex from which other apparent hormones are derived. An approach, not yet complete, to synthesis of cortisone from adequately available materials has been made. Another attack, still in the laboratory stage, is "biosynthesis"—production from animals' adrenal glands maintained in controlled solutions. As with cortisone, ACTH production is limited by supplies of raw materials, but even so, together they accounted for about \$20 million in sales in 1950. Demand measured in hundreds of millions of dollars awaits a low-cost cortisone process.

Other fields are showing activity, although not the striking advances evident in treatment of arthritis and many infections. One such is treatment of stomach ulcers, a large market with over 1.5 million new patients yearly. New ion-exchange resins reduce stomach acidity and permit gradual self-healing. Another product provides a protective film over the stomach lining, as well as neutralizing the acid. Another approach prevents the nervous spasm in the stomach which contributes to generation of acid. It is said to be useful in about 85 per cent

of the cases where the ulcer is the result of nervous tension, fatigue, or worry. A fourth approach is a product which appears to heal the ulcer itself. It has been highly successful in treating ulcers due to organic malformation, where surgery was formerly the only recourse. Since the raw material is limited in supply, this biological product is expensive, but if it can be synthesized, it should claim a large market.

Products for the treatment of high blood pressure are also being actively developed. While several drugs have been used to some extent in treating the estimated 18 million hypertensives in the U.S., physicians have placed major emphasis on slowing down the patient's activities. Purified alkaloids extracted from plant roots are now available and are used to reduce blood pressure, even though the causative conditions may remain. Frequently this is enough, since the patient is relieved of his symptoms and stops worrying about them, allowing the body to return to normal. Ion-exchange resins have been used also, providing the same effect as a low-medium diet. Nerve-blocking drugs have been offered for acute spasms, although they are not generally used for routine care.

The results of these developments show up in the sales of the pharmaceutical industry; sales of ethical drugs at the manufacturers' level have risen from \$545 million in 1947 to an estimated annual rate of over \$1 billion in 1951. Of this total, the leading recent developments—the antibiotics, anti-histamines, cortisone and ACTH—account for well over half.

Energy Exchanged by Tossing Protons Back and Forth

New Living Processes Theory

► A NEW IDEA is that living processes within our bodies exchange energy by tossing back and forth the hearts of hydrogen atoms, called protons.

Instead of electricity (which is the exchange of electrons) doing the work, the heavier protons are exchanged, in the novel conception of Dr. Theodore Shedlovsky, of the Rockefeller Institute for Medical Research, New York.

The biological battery that makes our nerves work uses these protons in the same way that an electric battery is operated by electrons, which flow in electricity.

Explanation of life processes on an electrical basis has been hampered by the lack of good conductors, such as metals, within living matter. But water and acids, which do exist in the body, can conduct protons. Pure water is an 80% conductor of protons compared with metal being 100% conducting for the electrons that make up electricity.

Protochemistry, as Dr. Shedlovsky calls it by analogy with electrochemistry, seems to appeal to many who

have studied life processes as a logical explanation of what can happen within living cells and tissues. But it will be very difficult to demonstrate the reality of the effect in living matter. Dr. Shedlovsky has experiments to show the existence of proton conductance, using the so-called glass electrode that is familiar to biologists. This is a tube of glass, through which the hydrogen ions, as the protons are also called, can pass.

The energy potential in such a glass "protode," as he calls it, combined with a fatty acid protode is sufficient to give the energy that living processes require.

"The biological bill for living energy can not be paid by electrons," Dr. Shadlovsky explained. "But it can be paid with protons."

In chemical terms, the new theory finds that the oxidation-reduction system does not operate in living matter, but the acid-base system does.

Just as theory has preceded practice in atomic energy and other fields, this new idea may help scientists to understand life more clearly.

One Blood Drop For Analysis

► SOME TIME in the future one drop of blood will be enough for a complete chemical analysis on which life-saving diagnosis of illness can be

made, Dr. Albert E. Sobel of the Jewish Hospital of Brooklyn, N.Y., predicted to the American Chemical Society.

"I Get Around"



**"New Information ... Underlying
Thermonuclear Reactions."**

Hydrogen Bomb Dialog

► THE OFFICIAL government attitude toward the so-called hydrogen bomb is set forth in the official transcript of the press conference held jointly by the U.S. Atomic Energy Commission and the Department of Defense on June 13 to discuss the operation Greenhouse in which atomic bombs were tested in April and May at Eniwetok. The following is an extract, with Gordon Dean, chairman of the U.S. Atomic Energy Commission doing the answers:

Question: Chairman Dean, can you say whether these tests have made you any more confident that you can produce the thermonuclear bomb?

Mr. Dean: I think we said that these did contribute to the research. When you say that, it leans in that direction. We certainly didn't say that we were disappointed in the research on thermonuclear. It contributed to our knowledge certainly.

Question: You speak once of eventual development, and that is, contributed toward eventual development.

Mr. Dean: Every time you contribute to your knowledge in a field such as this, the lighter elements, where you know very little of the reactions, you have contributed to your knowledge and therefore to what you are going to do with it.

Question: Sometimes when you find out that something won't work you have certainly contributed to your

knowledge. That was the point I was making.

Mr. Dean: I see. I misunderstood you.

Question: May I repeat the question?

Mr. Dean: Here is the way it was stated in Dr. Graves' statement: "We have gained new information and understanding of the basic phenomena underlying thermonuclear reactions." I think we will have to leave it there and not indicate whether we are gloomy or happy about it.

Question: Is it your intention to inform the American public if you do develop the H-bomb?

Mr. Dean: I think we will have to face up to that question.

Question: That is no answer. What do you mean? (No response).

Question: Mr. Dean, I don't understand.

Mr. Dean: I think the answer is really no comment at this point. I don't see how I can explain it.

Question: Can't you even answer whether you are going to tell us when we get the H-bomb?

Mr. Dean: I get the question all right. It is still "no comment."

Question: Mr. Dean, is the estimate that a hydrogen bomb might be a thousand times more powerful still a good semi-official working estimate?

Mr. Dean: There has never been any kind of official statement on the energy released by a thermonuclear weapon, never.

Carbon Cycle Outweighed By Proton-Proton Reaction

Sun Energy from Protons?

► THE SUN'S raging energy comes mostly from a sort of hydrogen bomb reaction, a crashing of ordinary hydrogen atomic hearts into one another.

Outweighing the famous "carbon cycle" of intricate atomic transmutations considered heretofore the main process in stoking the sun, the simple reaction of proton upon proton is considered by two physicists as the main way stars, including our sun, get their energy.

Dr. Edward Frieman of Brooklyn Polytechnic Institute and Dr. Lloyd Motz of Columbia University applied to this stellar energy problem new complex mathematical calculations as yet unpublished by other investigators.

The protons, or ordinary mass one hydrogen nuclei, interact with each other to produce a double-weight hydrogen atom and release energy in considerable amount. This takes place at the great heats that are achieved within the sun.

Unless such atomic alchemy does occur, the sun would run down and gradually cease to shine, leaving the earth cold and lifeless.

The famous "carbon cycle" was worked out in pre-A-bomb days by Dr. Hans Bethe, now of Cornell University. It explains the heat of the sun by a cycle of nuclear changes involving carbon, hydrogen, nitrogen and oxygen and leading to the disappearance of hydrogen and the forming of helium. A little matter is turned into energy, as in the atomic bomb.

This still happens but the new work by Drs. Frieman and Motz shows that the conversion of two atoms of hydrogen into deuterium, or double or heavy hydrogen, is likely to give more energy for the sun's use than the "carbon cycle." The energy is created from matter in both cases according to the famous Einstein relationship.

While the probable material of the hydrogen bomb now being developed by the Atomic Energy Commission is still highly secret, it is likely that triple-weight hydrogen or tritium would need to be used instead of ordinary hydrogen because here on earth we do not have the very high temperatures of the sun.

The corn earworm, worst insect enemy of sweetcorn, can be controlled in the garden with 20 drops to each ear of white mineral oil, or mineral oil containing 0.2% of pyrethrins, applied with a medicine dropper.

Louis Pasteur once said, "Laboratories and discoveries are correlative terms; if you suppress laboratories, physical science will become stricken with barrenness and death."

Negative Counterpart of Hydrogen Atom Heart

Anti-Proton Fundamental Particle

► THE LATEST and fifteenth elementary particle of matter is the anti-proton, or the negative counterpart of the heart of the hydrogen atom.

So far it is known by only one track on a cosmic ray disintegration photograph made by Dr. Robert B. Leighton, physicist at the California Institute of Technology.

This was in the decay of another seldom-photographed cosmic ray particle, called the neutral V particle. The negative proton track was like a conventional hydrogen heart track but its direction in the magnetic field showed that it was opposite in electric charge. Scientists never see the particles themselves, only the swath they cut in the photographic emulsion.

Only when many more such tracks are found will the discovery of the anti-proton be claimed with assurance.

There are three kinds of V-particles known, positive, negative and neutral. They are called V-particles because they form V-shaped tracks on the photographs of atomic disintegrations by which we know most about the constitution of matter. When Drs. G. D. Rochester and C. C. Butler of the University of Manchester, England, found them four years ago they were called heavy mesons. But the V-particles, all three kinds—positive, negative and neutral—are sufficiently different from the other mesons, known by the Greek letters mu and

pi, to be considered a different breed of particles.

All of these particles with mass, with the exception of the stable electron, proton and positron (positive electron) are very short-lived. Most of them exist less than a millionth of a second. The neutron, which triggers the atom bomb, can live about 20 minutes.

The anti-proton, now being sought, would have a short life. This is one of the reasons that it is hard to find. Dr. Carl D. Anderson of the California Institute of Technology, who won a Nobel prize for his discovery of the positron, expected the anti-proton to be found.

The anti-proton would be rated as the fifteenth elementary particle, if there are included the photon which is the massless "particle" of radiation, and an undiscovered entity, also without mass, called the neutrino which is required to balance out disintegrations from atomic collisions.

The anti-proton would be 1,845 times the mass of the electron, as is the proton, but it would have a negative charge upon it instead of the positive charge upon the proton.

Scientists travel to the tops of high mountains or send cosmic ray recorders to great heights by balloons, which are mistaken for "flying saucers." They do this to catch on sensitive photographic plates the debris of atom smashing caused by the mysterious

cosmic rays from outer space that come into the top of our atmosphere most strongly.

Dr. Leighton reported to the American Physical Society that he has found 53 V-particles among thousands of cosmic ray photographs taken.

A team from the University of Manchester took cosmic ray recording apparatus to the top of Pic-du-Midi in the Pyrenees. They recently reported

that in six months they captured 43 of the V-particle tracks.

Attention is being paid to these very infrequent and very technical happenings because that is the only way that we discover the constitution of the matter of the universe in the hope of molding it for use in peace and war.

Almost as "unpractical" experiments gave the world the information about the fission of uranium out of which grew the atomic bomb.

Photos Made Without Washing

➤ PHOTOGRAPHIC films and prints can be finished without the customary washing in water in a new process developed by the U.S. Army Signal Corps.

The process is particularly suitable for military forces in advanced areas where water is scarce. In addition to eliminating the need for water, it decreases the processing time. It is about ten times faster for films and twice as fast for prints as conventional methods.

Specially formulated Amidol developer, a stop bath and stabilizer solutions are used. The heart of the new stabilizing process is a solution containing thiourea. Water-resistant photographic paper is also used. This cuts down drying time.

In ordinary photo processing methods, films and prints are fixed in a hypo bath to remove unexposed silver salts. In this process the thiourea converts the unexposed silver compounds to a light-insensitive form.

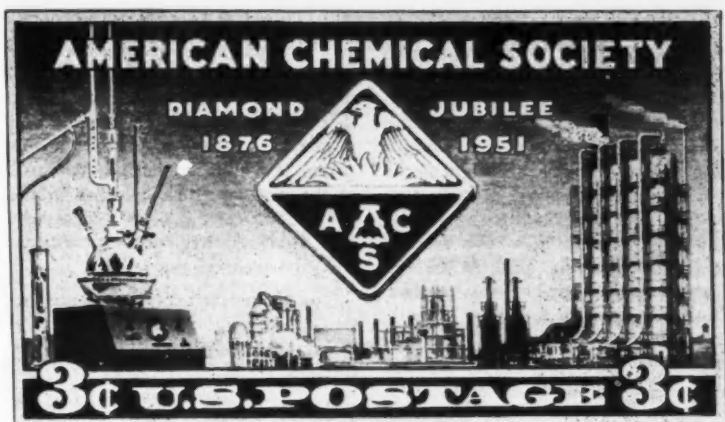
23rd Chemical Exposition in New York

➤ ALL available exhibit space on four floors of Grand Central Palace, New York, will be occupied by 381 companies when the 23rd Exposition of Chemical Industries is held Nov. 26 to Dec. 1.

Unprecedented production requirements of the defense program and civilian needs causes the Exposition to have added significance this year. There will be more interest than ever in the new and improved products

that will help to increase production.

Prominent in the display will be processing equipment that has been developed or re-designed to meet demands for greater capacity per ton of mass and per cubic foot of capacity. There will be new manufacturing materials, new and more efficient machinery and equipment to meet increased specifications required by intensified operation; and better new products at lower cost.



► *STAMP commemorating the founding of the American Chemical Society, which celebrates its seventy-fifth anniversary this year. The stamp goes on sale September 4 in New York City, as the World Chemical Conclave opens.*

World Chemical Conclave

► EIGHTEEN thousand chemists and chemical engineers from 42 countries are convening in New York the first two weeks in September for the World Chemical Conclave which will be the largest chemical gathering ever held.

Advances in many fields of research are being reported at the Conclave, which opens with the Diamond Jubilee meeting of the American Chemical Society and includes the Sixteenth Conference of the International Union of Pure and Applied Chemistry and the Twelfth International Congress of Pure and Applied Chemistry.

The week of the Society's Jubilee meeting has been designated as National Chemistry Week, and observances stressing the contributions of

the chemist and chemical engineer to better living have been scheduled in communities from coast to coast by the Society's 138 local sections.

A special anniversary stamp is one of five issues authorized this year by the U. S. Post Office Department. The 3¢ stamp that commemorates the 75th anniversary of the American Chemical Society, first placed on sale at New York, on Sept. 4, is 0.84 by 1.44 inches in dimensions, arranged horizontally with a double line frame, printed by the rotary process, electric-eye perforated, and issued in sheets of 50. An initial printing order of 110,000,000 American Chemical Society commemorative stamps was authorized. The color is maroon.

The stamp has for its central design the emblem of the American Chemical Society. On the left is pictured a modern alembic with supporting instruments, the conventional hydrometer and the modern ionization indicator, and to the right is the horizon of the chemical century typified by the towers of the catalytic cracking plant, a butadiene reactor, and a fractionating unit. Across the top arranged in one line of white face Gothic appears the wording "American Chemical Society" and just below arranged in two lines on each side of the emblem in white face Gothic is the wording "Diamond Jubilee 1876-1951."

Technical sessions of the Jubilee meeting will take the form of symposia sponsored by the society's twenty scientific and technical divisions. Frontiers in biochemistry, chemistry in cancer, the chemotherapy of tuberculosis, the origin of petroleum, synthetic rubber, the chemistry of tobacco, the current status of pesticides, and chemistry as an international science are among the varied symposium themes. More than 700 papers will be presented at a total of 80 symposia.

The American Chemical Society, had only 133 names on its first published list of members in 1876. It is now the world's largest professional association of scientists, with a membership of more than 66,000 chemists and chemical engineers.

The International Union of Pure and Applied Chemistry is a continu-

ing organization with headquarters in Paris which has 32 member countries represented by government agencies or outstanding chemical societies. The Union meets every two years in a member country to set uniform chemical standards for the scientists of the world in such fields as atomic weights, nomenclature, toxicology and industrial hygiene, and radioactivity.

The United States is represented in the Union by the National Research Council through its Division of Chemistry and Chemical Technology.

A total of 971 papers prepared by more than 2,500 authors are being presented at the Twelfth International Congress of Pure and Applied Chemistry. The Congress, which is not a continuing body like the Union, meets every fourth year in the country in which the Union is convening that year. The last Congress met in London in 1947.

All areas of modern chemistry are encompassed by the sixteen sections into which the Congress is organized—among them, air and stream pollution; biological chemistry; food, nutrition and agricultural chemistry; fuel, gas and petroleum chemistry; medicinal chemistry; nuclear chemistry; and professional training in chemistry.

Final sessions of the Conclave are held in Washington, where the International Union delegates participate in the 50th anniversary celebration of the National Bureau of Standards.

Traces of metallic substances in crude oil, or in the catalyst used in the cracking process of obtaining gasoline, decrease the amount of gasoline that can be extracted.

Understanding Chemical Changes

by SIR CYRIL HINSHELWOOD

This is an excerpt from the presidential address before the chemistry section, B.A.A.S., Edinburgh, August 1951 by the foreign secretary of the Royal Society and Dr. Lee's professor of chemistry at Oxford University.

► ONE OF THE GREAT waves of advance in the past century has been the detailed understanding of what actually happens in the course of chemical changes: how molecules collide and impart energy to one another, loosen their bonds, exchange their atoms, mutually induce electrical displacements, at times shed active fragments which create a sort of epidemic disturbance called a chain reaction, and at other times anchor themselves to surfaces where they enact their strange little dramas in a sort of Flatland of their own. The evolutions of atoms and molecules about which chemists now have precise knowledge are far more remarkable than those conceived by the poetic imagination of Lucretius, and this knowledge guides the manufacture of plastics, of dyes, and of every conceivable kind of chemical product. It is still advancing, and the first hesitant steps are being taken which transform an inductive into a deductive science. There is very far to go, but the journey is started.

In this matter of the mechanism of chemical reactions, I should like now to refer to the great field of the chem-

istry of the living cell, that wonderful skein of reactions out of which the life process is woven.

Chemistry, if not the father of life, is at least the godparent endowing it with its material substratum. In the last analysis the properties of the cell are determined by the molecular configuration of its substance, the arrangement of amino acid residues in proteins, the composition of the nucleotides, and the folding or piling of the chains and stacks which these various entities form. When a cell reproduces itself, protein chains must grow, like the polymeric molecules of the plastics industry. The nucleotide plates pile up, rather in the manner of crystal formation, but these two processes are subtly interlocked, and guide one another, as well as being in constant interplay with other reactions. The growth of a cell involves, as it were, an elaborate symphony of chemical reactions, the rules of which are slowly and surely being discovered. The chemical basis of the cell, with its function both in health and disease is thereby being gradually discerned.

What is dimly appearing includes the mutually aided autotosynthesis of protein and nucleic acid, changes in proportions of enzymatic material in response to the change reaction velocities imposed by various environments, and discontinuous modifications in the

molecular pattern caused by radiations or the accidents of abnormal cell division. The cell with the relatively stable structure of the molecular patterns which are the basis of its genes is a system of great traditional conservatism, but one which exhibits also response to change both of a long range and of a short range character, change imposed both by chance and by environment. Over and above this, we see the mass-mixing of chemical characters when cells undergo processes of sexual union.

The relative parts played by all these different effects are slowly being disentangled. The division of the cell itself, which is a necessity for the preservation of the type, is imposed by a physico-chemical influence known as the scale effect, and occurs without any doubt in response to a physico-chemical stimulus, about which more and more is gradually being discovered.

The selective influencing of cell processes occurs in many ways, and opens the door to the great practical field of chemotherapy. Chemotherapy itself is still in its infancy, and generations may well pass before it fulfils all its promise. There is ground neither for facile optimism nor for gloom, but simply a challenge to patient resolution. Growth must be long and difficult, because as yet the rational chemi-

cal basis for much that we know is incomplete. But the first dim outlines of it are certainly there.

At any rate the application of chemistry to health and healing is not likely to arouse the criticism of the layman except perhaps on the ground that it proceeds too slowly.

There is, however, a more sinister aspect even to these things. As the cell reactions disclose their secrets, as physiology advances, and as the relation of chemical structure to effect on cell and tissue clarifies itself, there will emerge the possibility of deep-seated chemical intervention into processes which are now normally inviolate. Chemically induced mutations of cells are already known in a crude fashion, the influence of drugs on personality already exercises medicine and law, and the day may well come when a conscious moulding of individuals and even of races will present problems of fearful fascination.

If this day does indeed dawn the sky will ring more wildly than ever with cries against science, and the old battle of ultimate values will be joined more vigorously than ever. But it will still be those of little faith who fear the conscious intervention of mankind in the fashioning of its own destiny and who oppose what could equally well be represented by those so minded as part of a great purpose.

The 100-year-old Bessemer process is the oldest steelmaking method now in use; the name comes from a British scientist, Sir Henry Bessemer, but it was independently discovered by an American, William Kelley.

To avoid future shortages of pepper, American chemists are trying to make a synthetic spice; to be satisfactory, it must have proper "bite" and volatile quality to affect the sense of smell properly.

Argon, Krypton, Xenon Caged in Quinol Crystals

Inert Gases Form Strange Substances

► THE inert gases argon, krypton and xenon, called inert because they are incapable of forming true chemical compounds, have been caged up to form stable solid crystalline substances. This new process was described and demonstrated to the Royal Institution in London by H. M. Powell, Oxford University chemical crystallographer.

The cage in which the aloof and volatile molecules of the inert gases are trapped is made up of ordinary quinol, a photographic developing material, also known as hydroquinone. The trapping is done by exposing the gas under moderate pressure to a saturated quinol solution and cooling the system to cause the quinol to crystallize out.

The crystals which form under these conditions are stable substances made up of three parts quinol to one of the inert element.

The crystals so formed contain about 70 times their own volume of gas, so that the gas is effectively contained under a pressure of 70 at-

mospheres, yet the crystals are very stable to ordinary handling. If, however, the crystals are destroyed by dissolving or melting them, then the freed gas escapes quickly.

The explanation for this phenomenon is, according to Mr. Powell, that the crystallizing quinol molecules form a honeycomb of minute cell's, or cages, which are just the right size to hold the gas molecules, whose size is of the order of 4 Angstrom units.

Other molecules of similar size—e.g. sulfur dioxide, hydrogen sulfide, hydrochloric acid, hydrobromic acid, hydrocyanic acid, carbon dioxide, formic acid, methyl alcohol, methyl cyanide, and acetylene—can also be trapped to form stable crystalline compounds with quinol.

The name given to these unorthodox crystalline substances is "clathrate compounds," from the Welsh word "clathratus," meaning closed or protected by cross-bars of a trellis. The sole determining factor in the formation of clathrate compounds is proper molecular size. Molecules

On The Back Cover

► CLATHRATE CRYSTALS containing argon trapped in a quinol lattice have this form. The photograph shows them enlarged. The actual length of the center crystal is approximately one centimeter.

which are too large just won't fit into the cages: those which are too small escape through the lattice-work walls.

Other examples of clathrate compounds are those formed between a nickel cyanide ammonia complex, $\text{Ni}(\text{CN}) \cdot \text{NH}_3$, and one molecule of benzene, thiophene, furane, pyrrole, aniline or phenol, all molecules of a similar size.

Since clathrate compound formation is based on molecule size rather

than on chemical similarity, it can be used practically in the separation of chemically similar but physically different molecules.

For example, in one simple operation benzene can be separated from other contaminating hydrocarbons and produced in 99.992% purity by forming the clathrate compound with nickel cyanide ammonia and then releasing the caged benzene by dissolving the crystals.

Silicone Rubber Bonded to Metals

► A GLUE-LIKE bonding material promises to increase the use of silicone rubbers. It makes a firm union between them and such materials as steel, glass, aluminum, ceramics, tin, copper and other metals.

There are many applications for which this war-developed synthetic rubber is particularly suitable, even more suitable than natural rubbers and other synthetics. It withstands relatively high and low temperatures. It is little affected by ultraviolet radiation. Like other silicones, it is a com-

pound of organic material with silicon.

To produce the bond, this new liquid material developed by General Electric is brushed or sprayed on the glass or metal surface to which the silicone rubber is to be attached. After drying, the surfaces are placed together under light pressure at about 250 degrees Fahrenheit. The resulting bond withstands temperatures from 85 degrees below zero to 500 degrees above, and is said to make a bond with a strength of about 700 pounds per square inch of holding area.

Cleaner Cotton With Leaf Shedding Chemicals

► BETTER GRADES of cotton lint are expected this year through wider use of chemicals that force the cotton plants to shed their leaves earlier, permitting harvest of cleaner bolls.

Use of these chemicals, technically known as defoliants, will help the U.S. meet its 1951 production goal of 16 million bales.

Cotton plants can be forced to shed

their leaves only when they are fully mature so correct timing is essential in spraying or dusting the defoliants. The leaf-shedding chemicals, such as calcium cyanamide, help give cleaner harvests whether the cotton is picked by hand or by mechanical picker. The treatment also aids in insect control and reduces the number of boll weevils carried over in the field.

Chemicals Make Thread For Temporary Use Only

New Cotton Dissolves in Water

► A TRICK new cotton simply disappears when you wash it.

Cotton is normally stronger than any other apparel fiber and is particularly strong when wet, yet one of the very latest developments is a thread that looks like ordinary cotton thread, but dissolves and disappears when dropped into water. This thread, which probably won't be commercially available for several years, is expected to be useful where a thread is needed only temporarily.

Water-soluble thread seems ideal for a scaffolding or framework yarn in

laces and open-work materials, for basting threads and for connecting-yarns where the thread is needed for a time, then must be removed. Such thread, though relatively strong, can simply be washed out in water.

This special thread is made by treating cotton thread with solutions of two chemicals, monochloroacetic acid sodium hydroxide. Monochloroacetic acid is a relatively simple organic acid with the chemical formula $\text{Cl-CH}_2\text{-COOH}$: sodium hydroxide is more familiar as the common household caustic, lye.

► *DISAPPEARING cotton yarn, which looks and feels like ordinary cotton, balloons out when wet and disappears in water. The cellulose has been modified to carboxymethyl cellulose, CMC.*



When a strong solution of lye, say 15% to 20% in water, is placed on cotton, it causes a change in the cotton which is called "mercerization." If the cotton is held loosely, it swells and becomes more absorbent; but if the yarn or cloth is held under tension, it increases in strength and takes on a sheen.

If the thread is first treated with a small amount of a strong solution of monochloroacetic acid, a vinegar derivative, and then with a concentrated lye solution, the cotton swells and reacts with the acid in such a manner that the " CH_2COOH " part becomes attached to the cellulose molecule of which the cotton fiber is made up. This new group attached to the cellulose makes it possible for the cotton to dissolve in water.

Through its chemical treatment, this yarn has been changed into sodium carboxymethyl cellulose, but the cellulose was modified in such a way that

the original fibrous form is retained. This treatment was developed at the Southern Regional Research Laboratory of the U. S. Department of Agriculture.

A drop of water will make the tricky new yarn balloon out and become easy to break at the wet spot. It will disappear entirely in water.

Cotton yarn that disappears in water, cotton that does not soil easily and comes clean quickly, and cotton with a coating that keeps water out but lets moisture vapor through have been collected for you by Science Service. These and several other interesting cottons, along with details of their manufacture and suggested experiments, are included in the kit which you can secure for the nominal fee of 75 cents. Write Science Service, 1719 N St., N.W., Washington 6, D.C., and ask for the New Cotton Developments kit.

Paper Test Tells Water in Alcohol

► SIMPLY by putting some alcohol on a specially treated strip of blotting paper, small quantities of water in alcohol can be detected.

This new and delicate chromatograph test developed by Dr. J. E. C. Stringer of Vickers-Armstrongs at Newcastle upon Tyne and reported to the journal, *Nature*, is expected to determine from a tenth to a half per cent of water in alcohol used for chemical purposes.

The alcohol being tested is allowed to soak up through a strip of paper, with two chemicals impregnated in

it. First it reaches a zone of iron sulfate, which is dissolved in the water and not in the alcohol. When this salt picked up by the water reaches the area containing potassium ferricyanide, a blue coloration consisting of ferric ferrocyanide is produced. The extent and intensity of the coloration depends upon the amount of water present.

Unlike beverage alcohol, that used for chemical work should contain little water and it is often desired to know just how much.

Heart, Artery and Blood Chemistry

➤ BECAUSE diseases of the heart and circulatory system are the number one cause of death, it is quite fitting that there is accelerated research on the chemistry of heart, arteries and blood and their medical applications.

Chemicals are being explored that reduce high blood pressure.

High Blood Pressure

Chemicals known by the general name of methonium halides reduce high blood pressure and bring improvement in eye symptoms such as retinal hemorrhages, in headaches and dizziness, exercise capacity and heart disorders.

Scientists in England have been experimenting with them. Successful use of one of these chemicals, hexamethonium bromide, is reported by Dr. F. Horace Smirk of the University of Otago in New Zealand.

Two or three injections under the skin daily make it possible, Dr. Smirk finds, without adverse symptoms, to secure a more substantial reduction of blood pressure than has ordinarily been practicable hitherto.

Patients develop tolerance to the chemicals from repeated doses, making it necessary to increase the dosage. The beginning dose of 15 milligrams sometimes has to be increased to as much as 200 milligrams.

Using an electrically driven syringe, Dr. Smirk has been able to give slow, continuous injections of the drug over a 24-hour period. By refilling the

syringe daily, this can be kept up for 10 days or longer. By this means the blood pressure of severely sick patients, with pressures at 260/150, for example, has been kept at about normal levels of 130/90 day and night for 10 days or more.

In severe cases it has been possible by a methonium injection to reduce the blood pressure by as much as 140 systolic and 80 diastolic, "which reduction," Dr. Smirk points out, "is of the same order as the entire normal blood pressure (120 systolic, 75 diastolic)."

The effects of test doses have been studied in 170 patients. Treatment of one to 16 months duration has been in progress in 68 patients, including high blood pressure of the malignant, essential, renal (kidney) and post-pregnancy toxemic types.

Dr. Smirk concludes that blood pressure reduction can be obtained in high blood pressure cases irrespective of cause and also in normal controls.

Synthetic Combats Pressure

A new synthetic chemical may help some patients with high blood pressure.

Drs. Roy Hertz, Milton J. Allen and Wm. W. Tullner, of the U. S. National Cancer Institute report that the chemical, called Amphenone B, acts on the pituitary gland in the head to cause an enlargement of adrenal and thyroid glands. At the same time, the amount of hormones

produced by these chemically enlarged glands is reduced.

Amphenone B is the first synthetic chemical which has this effect on the adrenal glands. Its effect on the thyroid is like that of such drugs as thiouracil. Thiouracil and related chemicals are already being used to check overactive thyroids instead of removing the glands by surgical operation.

Amphenone B offers the possibility of the same kind of "medical operation" on the adrenal glands in patients whose high blood pressure is due to overactivity of these glands.

Patients with cancer of the adrenals might also be helped by Amphenone B, whereas now they must undergo surgery to have the cancer removed.

Trial of the new chemical in cases of high blood pressure is now under way but it is too early to know what the results will be. The effects on the adrenal and thyroid glands were discovered in tests with rats.

In the early stages of the research, Dr. Hertz and associates thought the new synthetic chemical might become a substitute for ACTH, the anti-arthritis chemical which now must be obtained from hog pituitary glands. But Amphenone B turned out not to be a substitute for ACTH and Dr. Hertz suspects it might injure arthritic patients because it prevents the adrenal glands from producing their anti-arthritis hormone, cortisone.

Old Drug For Pressure

An old abandoned drug has been modernized into effective treatment for cases of high blood pressure in which heart failure or brain hemorrhage threatens.

The drug is called Protoveratrine. Modern chemists have purified it from a substance from a common European weed. And a majority of 25 patients with severe high blood pressure have had their blood pressures reduced by it, Dr. Sibley W. Hoobler of the University of Michigan has reported.

Headaches, confusion and convulsions were relieved, along with reduction of blood pressure, as long as the patient took the drug. They got it in tablets to be taken three times a day.

Protoveratrine is not yet available for general practice and its use must be strictly supervised. It is not for the mild case of high blood pressure nor, Dr. Hoobler said, for severe cases until other treatments have been tried.

The drug was first given in "shots" by Dr. Otto Kray of Harvard Medical School in 1949. Tablets of it, to be swallowed instead of injected with a needle, were supplied Dr. Hoobler by Eli Lilly and Co. of Indianapolis.

Nervous Blood Pressure

Two drugs that relieve high blood pressure of nervous origin have been reported by Dr. Henry A. Schroeder of Washington University School of Medicine, St. Louis.

The drugs are known by their chemical names of 1-hydrazinophthalazine and 1-hydrazino-4 methylphthalazine.

After it was found that these drugs could keep the blood pressures of dogs with high blood pressure at normal or near normal levels, they were given to 30 patients.

"Considerable sustained action was shown in reducing blood pressure in

hypertension of nervous origin, but little or no effects were seen in hypertension associated with the kidney," Dr. Schroeder said.

The drugs were given by mouth. In the beginning of treatment with them, the patients suffered headache, nausea and vomiting, which were controlled by anti-histaminic drugs, and low blood pressure associated with change in posture. After repeated doses, these toxic signs grew less.

Brain Chemical Cause

The high blood pressure that comes under conditions of unusual stress, anxiety and mental tension may be due to a chemical in the brain. Discovery of the chemical and its possible role in some cases of high blood pressure was announced by Drs. Robert D. Taylor, Irvine H. Page and A. C. Corcoran of the Cleveland Clinic.

A relatively new drug that has been helping some patients with this nervous tension type of high blood pressure counteracts the effects of the brain chemical in dogs. This seems to strengthen the idea that the brain chemical is the cause of some human high blood pressure.

The brain chemical has not yet been identified chemically. It is not the same as the known blood-pressure raising substances, adrenalin, arterenol, pitressin, renin and angiotonin. It may be the same as the substance in fluid surrounding the brain which, Dr. Page found in 1935, raises the blood pressure in cats.

The drug that counteracts this brain chemical is hydrazino-phthalazine. This drug is not yet for sale. It does not cure all forms of high blood

pressure. It must be given every day, and often there are bad reactions which complicate treatment with it. Dr. Francois Reubi of Basle, Switzerland, was apparently the first to suggest it might be helpful in high blood pressure. Dr. Henry Schroeder of St. Louis has confirmed this view as regards high blood pressure seemingly of nervous origin.

The discovery of the blood-pressure-raising brain chemical seems to solve some of the riddles of high blood pressure. Doctors have long believed that certain nerves were responsible for high blood pressure by their action on the walls of the blood vessels, causing these to constrict unduly. Nerve-cutting operations done to relieve high blood pressure, are based on this theory. The operations, however, are not always successful.

Now it appears that the nerves affect blood pressure but not alone by their action on blood vessel walls, which might be called their nervous action. They apparently also affect blood pressure by producing a chemical substance that acts like a hormone, or gland chemical.

Two New Drugs

Two new drugs are reported for the fight against heart disease.

One is called triethanolamine trinitrate. From laboratory tests it promises to have a more lasting effect in dilating the heart's blood vessels than nitroglycerine, one of the standard chemicals used to treat the heart disease called angina pectoris. The tests were reported by Drs. K. I. Melville and F. C. Lu of McGill University, Montreal.

The other drug, commercially available under the name, Myocardone, is extracted from beef hearts. Drs. Allen Weiss, David H. Feldman and Frederick Steigmann of Cook County Hospital, Chicago, tried it on 58 patients. They reported the following results: Definite improvement in the patient's feeling in two-thirds of the angina patients; mild to moderate improvement in patients with high blood pressure symptoms; little improvement in patients with acute decompensated heart conditions, two of whom died.

Artery Hardening Link

A different approach to the possible link between fatty substances in the blood, such as cholesterol, and arteriosclerosis, popularly called artery hardening, was reported at the recent meeting of the American Heart Association.

According to one recent and widely popularized theory, the dangerous artery condition is related to an overabundance of giant molecules of fatty substance in the blood and the consequent means of prevention and cure is claimed to be through a diet very low in cholesterol.

An upset balance between cholesterol and another class of fatty substances in blood, the phospholipids, may, instead, be the cause of the artery hardening condition. This theory was presented by Drs. Alfred Steiner, Forest E. Kendall and James A. L. Mathers, a research team connected with Goldwater Memorial Hospital and the College of Physicians and Surgeons, Columbia University, New York.

Dr. Steiner and his associates studied the fatty substances in the blood of 82 patients who had suffered coronary thrombosis (closure of a coronary artery), and compared them with 123 healthy adults. It was found that the two principal fatty components of the blood, cholesterol and phospholipids, both increased in the diseased patients, but the cholesterol rose at a more rapid rate than the phospholipids. This the scientists consider especially significant since it is believed that the phospholipids are responsible for keeping the cholesterol dissolved in the blood so that it cannot form a fatty lining that would narrow an artery.

When the increase in cholesterol gets ahead of the increase in the controlling phospholipids, it is believed that the freed cholesterol may cling to the artery wall, thus narrowing the vessel and reducing the blood flow to such vital areas as the heart or brain. A sudden block in the blood supply to the heart, caused by formation of a clot in a narrowed artery, is known as a coronary thrombosis. When blood to the brain is cut off, a "stroke" results.

"As more information becomes available, it has become increasingly apparent that coronary arteriosclerosis is associated with widespread abnormalities in the pattern of fatty substances in the blood," the scientists pointed out. "It is not possible as yet to determine which fatty constituents of the serum are most important in the production of arteriosclerosis. However, it can be stated that when one fatty component is abnormal it is more than likely that there will be other abnormalities."

Arteries Make Chemicals

Your arteries apparently are even more important to you than anybody has previously suspected, according to a series of experiments that have been completed in the University of California School of Medicine.

In the past most medical scientists have considered the arteries to be somewhat inert pipes through which the blood supply was channeled from one part of the body to another. They were not considered to be important in biochemical activities.

But recent work has shown that the arteries in addition have many of the characteristics of vital organs like the liver. The arteries can build complex and essential compounds out of simple organic materials. And they can break down complex compounds into simple ones. This means the arteries have enzyme systems.

So far the investigators have shown, by keeping animal arteries "alive" in nutrient solutions, that these biological conduits can synthesize cholesterol and phospholipids, both of which are common, complex body chemicals. They have also shown that the arteries use significant amounts of oxygen; that is, that they "breathe."

The research touches on critically important questions that will take years to answer. To what extent are functions now assigned to other vital organs within the province of the arteries? How much biochemical influence do the arteries have on the foodstuffs, in the form of blood, that they transport? How big a role do the arteries play in body chemistry?

The work has been done in the laboratory of Dr. I. L. Chaikoff, pro-

fessor of physiology. The most recent work, on the synthesis of cholesterol, was reported (*Science*, June 29, 1951) by Dr. M. D. Siperstein, U.S. Public Health Service Fellow, Dr. Chaikoff, and Dr. S. S. Chernick, assistant physiologist.

Cholesterol, a whitish chemical, is associated with hardening of the arteries. Deposits of the chemical are formed on the blood vessel walls, reducing flexibility and the ability of the vessels to carry blood.

The scientists pointed out that it is well known that diet is important in cholesterol synthesis. It had already been demonstrated at Berkeley and elsewhere that the liver and other organs can synthesize cholesterol from simple compounds.

The researchers wanted to know if the artery itself could perform its own synthesis. With the arterial tissue in the nutrient solution they placed acetate, a common, simple compound, labeled with radioactive carbon. In three hours they isolated cholesterol from the arterial tissue. Presence of radiocarbon in the cholesterol showed that the acetate had been incorporated into the cholesterol by the arteries. While the quantity of cholesterol was small, the synthesis being about one-tenth the capacity of the liver, it was consistent.

The scientists concluded that such synthesis probably is a part of a generalized pattern that occurs throughout the body, that it can play a role in hardening of the arteries. They added that the relative roles of diet and of such synthesis in hardening of the arteries remain to be determined.

Heart Breaks Down Drug

First evidence that the heart can absorb a drug and break it down into other compounds has been obtained from radioactive digitoxin from the University of Chicago's "atomic farm."

Digitoxin is the most active compound in the familiar heart medicine, digitalis. It is obtained from the foxglove plant. The plants were made to

produce radioactive digitoxin by making them breathe radioactive carbon dioxide.

From 40% to 50% of the drug was converted to other compounds by the heart, Dr. A. Sjoerdsma of Michael Reese Hospital, Chicago, and Dr. Conrad C. Fisher of the university have reported to the Federation of American Societies for Experimental Biology.

Symposium on Chemistry of ACTH

► AN INTERNATIONAL symposium at which leading European and American biochemists will discuss the chemistry of ACTH will be held in Chicago on September 18.

Many prominent foreign chemists will be in the United States for the international chemical meetings most of them as guests of American chemical and pharmaceutical organizations. Armour and Company research division, headed by Victor Conquest, vice-president, has interested itself especially in three younger men, two English and one Swedish, who have never before had opportunity to meet American biochemists.

These three are: George W. Kenner, chemist, and Fred Sanger, biochemist, both of Cambridge University, England; and Jerker Porath, biochemist of Uppsala University, Sweden.

Other visitors include: Prof. Arne Tiselius, biochemist of the University of Uppsala, Sweden, winner of the Nobel prize in chemistry in 1948; Prof. A. R. Todd, Cambridge bio-

chemist; and C. J. O'R. Morris of the London, England, County Hospital.

Scheduled to present formal papers are: Prof. David F. Waugh, biochemist of the Massachusetts Institute of Technology; E. B. Astwood, Tufts College, chemist; Emil M. Smith, M.D., and Prof. George W. Sayers, biochemist, both of the University of Utah; Prof. Sidney W. Fox, biochemist, Iowa State University; Prof. Wendell M. Stanley, C. H. Li and J. Ieuan Harris, biochemists, and Fred W. Carpenter, virologist, all of the University of California, and Wilfred White and Joseph D. Fischer, biochemists of the Armour and Company research division. "One of the most important chemical frontiers is the structure of proteins," Mr. Conquest explained.

"We feel certain that bringing together a group of men so outstanding in that exploration as these men are for exchange of ideas and discussion will advance the whole process tremendously."

Vitamins Combat Drink Craving, Aid Treatment and Safe Drinking

Vitamins to Fight Alcohol

► VITAMINS have been suggested from time to time for use in chemical warfare against alcoholism. These are some of the latest suggestions contained in research reports.

Eat your vitamins regularly and you won't crave drink. This advice is based on studies reported by Drs. E. O'Malley, V. Heggie, M. Trulson, R. Fleming and F. J. Stare of the Harvard School of Public Health and the Alcoholic Clinic of Peter Bent Brigham Hospital, Boston.

Noting that rats voluntarily took more alcohol when half-starving on a "marginal diet" and took less when huge doses of vitamins were given, the Boston scientists tried giving vitamins to 50 chronic alcoholics. About half the alcoholics were given huge daily doses of most of the known vitamins. The same number got mock-vitamin pills. After several weeks, the two kinds of pills were reversed. Those that had been getting vitamins got none, the others got the vitamins.

Result: Less craving for alcohol in many patients when getting the extra vitamins. Most of them getting the vitamins also reported feeling better. The studies were reported to the Federation of Societies for Experimental Biology.

Vitamin C makes antabuse treatment of alcoholism safer and easier to carry out, Drs. Wiktor W. Nowinski and Grady Niblo of the University of Texas Medical Branch at Galves-

ton have reported to the American Psychiatric Association.

Antabuse is a drug which Danish scientists found would make alcoholics want to stop drinking after the first drink because of the unpleasant, even frightening feeling it produces when taken before drinking alcohol.

Vitamin C, the Texas doctors reported, does not lessen the effectiveness of antabuse but lessens many of the undesirable effects that have nothing to do with its anti-alcoholic action.

Food and vitamin pills will "cure" alcoholics "so they can drink occasionally without any excessive urge," Dr. Roger J. Williams, professor of chemistry and director of the Biochemical Institute at the University of Texas here, claims in his new book, *Nutrition and Alcoholism*.

Merely taking vitamins in addition to a good diet, however, is not the method Dr. Williams claims has cured alcoholics. The diet and vitamins must be specially prescribed for each patient.

This is because Dr. Williams believes some people are born with a disturbance of body chemistry conducive to development of deficiencies even when eating what is a nourishing diet for most people. As a result, according to this theory, various diseases including alcoholism may develop. To remedy the condition, according to the theory, the patient must get the particular vitamins his body needs.

**Antibiotic Wonder Drugs Plus
Vitamin B12 Give Faster Meat Production**

Antibiotic and Vitamin Spurt Growth

► A NEW CHEMICAL team is putting more meat on the nation's poultry and hogs. The team is made up of vitamin B12 and such wonder remedies—antibiotics, they are called—as terramycin, aureomycin, penicillin, streptomycin and bacitracin.

Discovery of the growth spurt of animals when these two factors are added to diets is so new that exact growth effects are still being tested.

Both partners in the team are potent tools for man's good when used alone. The antibiotics are effective against a host of disease-spreading organisms. Vitamin B12 is one of the most active biological chemicals known, effective in the treatment of pernicious anemia.

The kick to growth these two chemicals give when teamed together was discovered accidentally: aureomycin just happened to be in one of the commercial B12 supplements fed to poultry.

Even without the extra spurt given by the antibiotics, however, vitamin B12 deals a plenty potent punch:

Extremely tiny amounts of it, so minute you need a microscope to see the dose, will give a miraculous effect to pernicious anemia victims.

Equally small amounts will put weight on hogs, make chickens grow faster and hatch more eggs, give us plump turkeys sooner than by ordinary diet.

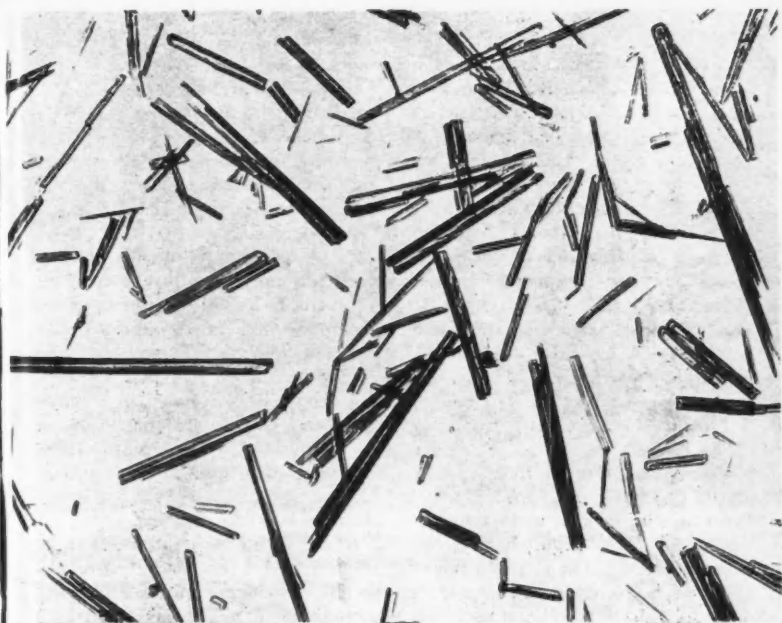
Some scientists say young children who are under par and have no appetite, ask for second helpings and improve in alertness and general behavior when fed very small amounts of vitamin B12.

Purified B12 forms slender, needle-like red crystals. But it took about 25 years of research in two totally different fields to get the pure crystals and to pin on the vitamin its duplicate role as a growth promoter and an anti-pernicious anemia factor.

For many years, farmers and poultry specialists have known that poultry and swine must have certain proteins, particularly during their growth period. And they have known that these necessary proteins are not available from proteins of vegetable origin. On the other hand, ruminants, cud-chewers such as cows or goats, are evidently equipped to make their own required growth factors.

Vitamin B12 has always been present in poultry and swine feeds. Before the vitamin was identified, it was supplied in natural form by such feed supplements as fish and meat meals and dried skim milk. It was known as AP for the animal protein factor. But there are not enough of the extra feeds to go around, the supply meeting only about half the demand required for the best production of pork and poultry.

With the discovery of the growth spurt given by the antibiotic-vitamin



► *CRYSTALS of the new Vitamin B12 team up with antibiotics to promote the growth of chickens, turkeys and hogs, a boon to the nation's farmers. This vitamin, shown under a high-powered microscope, has also proved to be effective in the treatment of pernicious anemia.*

B12 combination, some poultry specialists are predicting that by developing new sources, as much as 90% of the total poultry feed can be supplemented by this chemical team added to grain, grain by-products and soybean oil meal. Built-up floor litter as part of the diet will help to give the same growth results as the added chemical combination.

The chemical structure of vitamin B12 is gradually being unfolded. The most surprising discovery, announced almost simultaneously in England

and the United States in 1949, is that B12 contains cobalt. This is the first time that this diet-vital metal has been found in a pure substance of biological origin.

Since cobalt is known to be needed by cows and other cud-chewing animals for the production of milk, scientists are now trying to find what connection there is between that fact and the presence of cobalt in vitamin B12. Cobalt is needed in very small amounts for good human nutrition.

The story of the discovery of vita-

min B12 begins more than 20 years ago when Dr. G. H. Whipple of University of Rochester Medical School, Dr. W. P. Murphy, Boston, and the late Dr. G. R. Minot found that eating liver is a workable dietary cure for pernicious anemia. For this achievement they were awarded the Nobel prize in medicine in 1934.

Pernicious anemia is a disease of the bone marrow, site of the body's blood building equipment. It once claimed more than 50,000 victims per year. Those afflicted with this stubborn, once-fatal disease are not able to produce the required red blood cells in their own bodies.

The liver diet cure, wonderful though it was, was also a difficult one for the patient—for it took about a pound of liver a day to be effective. Liver once a week or so in a moderate helping is a highly-to-be-recommended practice, but eating a pound of liver a day, even spread over three meals a day, is a rather formidable task.

Chemists, therefore, put every effort into concentrating that portion of the liver that saved the anemia-afflicted patients. By 1943, they had succeeded in reducing the amount to be taken to the point where patients could survive on only one milligram per day of concentrated liver extract. This is about the equivalent in weight of one piece of a postage stamp cut up into 50 parts.

Of this one milligram, only a very small fraction is the part responsible for the extract's healing properties. Yet it takes about a ton of liver to get around 20 milligrams of the potent extract. So the search for the powerful portion continued.

In April, 1948, Dr. E. L. Rickes and associates of Merck and Co. announced they had isolated, from highly concentrated liver extract, a few small crystals, the new vitamin B12. The following week, Dr. E. Lester Smith, of the Glaxo Laboratories in England, announced that he had also isolated the anti-pernicious anemia factor.

Now pernicious anemia victims need take only very tiny doses of vitamin B12 to hold the disease in check. Recent studies have indicated that each new red blood cell gets one molecule of B12 for its very own.

Vitamin B12 is now being made from the same mold that produces streptomycin, but it is possible that an even cheaper method of production may be found when the riddle of its chemical formula is solved.

If it had not been for research in an entirely different field, discovery of the B12 producing qualities of streptomycin mold might have been long delayed. Scientists in this field wanted to learn more about the diet needs of animals and so improve their growth, thus give humans better food. Intensive work on this problem has also been going on since the late 1920's, although most of the studies were made since the last war.

In 1946, Drs. C. A. Cary, A. M. Hartman and their co-workers at the Department of Agriculture reported a new factor—they called it "X"—that seemed to be essential for normal growth in young rats. Milk and commercial liver extract were among the substances that would correct a deficiency of this factor.

Looking for a guinea pig on which to test this rat-growth factor, Dr. Mary



► *AUREOMYCIN added to the feed, in the proportion of ten grams per ton, gave the hen on the right the advantage in weight over the one on the left, which had merely the normal poultry diet.*

Shorb, working at the University of Maryland, studied the micro-organism, *Lactobacillus lactis* Dorner. She found that this micro-organism required not one, but two factors for growth. One is called the TJ factor for the tomato juice in which it is found. The other is the LLD factor. LLD is the short name for *Lactobacillus lactis* Dorner. This LLD was found in the highest concentrations in liver extracts, and the more potent the liver extract in helping pernicious anemia patients, the more powerful the LLD factor.

Because of this, Dr. Shorb thought that the LLD factor required by the micro-organism for growth and the chemical that gave such relief to

anemia victims were identical. After crystalline B12 had been isolated, it was tested with the micro-organism and showed LLD activity. Dr. Shorb's suggestion had been right.

Dr. Rickes then looked for the new vitamin B12 in other biological materials besides liver, using Dr. Shorb's micro-organism as a guinea pig. He found several. One, a red crystalline compound, was isolated from the mold that gives us streptomycin. Tests showed that this crystalline compound had the same chemical and physical properties as the just-isolated vitamin B12.

The accidentally discovered growth spurt given by the vitamin-antibiotic combination can be shown by ex-

ample. Here is how the combination puts extra weight on animals:

A typical chicken grower, using the so-called high-energy diet, containing some animal proteins, is doing well if his chickens weigh three pounds at the end of 12 weeks. And that weight is reached only by feeding the flock three pounds of animal-protein enriched feed per pound of gain.

If, however, he adds vitamin B12 to the same amount of feed, his broilers will be up to three pounds in 11 weeks. But with a combination of B12 and an antibiotic, he can get a three-pound broiler at the end of ten weeks, using only two and a half pounds of

feed per pound of gain to reach this added weight in a shorter time.

Exactly which antibiotic combined with vitamin B12 will give the best growth for chickens, for turkeys and for hogs is now being tested. There is some evidence that results are more promising with one antibiotic for chickens, another for swine.

Thus the search for the anti-pernicious anemia factor in liver and the hunt for better animal feed came together in one vitamin, the twelfth in the series of B vitamins. And this vitamin, combined with one of the antibiotics, is adding greatly to our poultry and hog production.

Wrapping Protects from Corrosion.

► LONG-TIME protection for objects of metal from rust and other corrosion is promised with a simple packaging method that uses a vapor from new chemical crystals placed on the inside of wrapping paper.

The chemical is a product of the Shell Oil Company, and is technically called "volatile corrosion inhibitor." Its chemical composition is not yet revealed. It is a powdery substance that releases a thin vapor which, inside the wrapper, forms an invisible protective shield around the metal.

In use, paper wrapping, coated with the chemical crystals, is put around the object to be protected and sealed. The vapor surrounds the metal, penetrating to the smallest parts with its protective film to insure complete protection. It gets into the most inaccessible parts.

This volatile corrosion inhibitor may some day be used by the military

services to protect war equipment when not in use from rust and corrosion. Tests are now being made by the Army Ordnance Research and Development Division.

If found successful after sufficient experimental trials, it would do away with the present method of coating such equipment as guns with heavy grease, which gives little protection to inaccessible parts and is always hard to clean off when the equipment is needed for use again.

The experiments now being conducted by Army Ordnance may improve the old protective "cocoon" used to protect planes, guns and vessels from severe weather conditions. Researchers have developed a "shroud" or "cloak" treated with the chemical which may be placed over aircraft engines and objects of similar size in one operation. To date, tests have produced satisfactory results.

**New Patents Granted
On a Variety of Subjects**

Ideas of Interest to Chemists

Copies of complete patent specifications may be obtained from the Commissioner of Patents, Washington 25, D.C. Order by number and enclose 25 cents in cash, money order or Patent Office coupon (not stamps) for each patent ordered.

High-Quality Magnesium Alloys

► WIDER USE of magnesium in many applications is promised with British-developed magnesium alloys which have improved mechanical properties, offering advantages both in the cast and wrought conditions. They contain 85% magnesium, the rest being certain so-called rare-earth metals, neodymium, lanthanum and others. Cerium is removed from the rare earth metals used in order to improve resistance to corrosion.

Alfred Claude Jessup, Edward Frederick Emley and Philip Andrew Fisher are the inventors. All are at Clifton Junction, near Manchester, England, and their rights to patent 2,549,955 have been assigned to Magnesium Elektron Limited of the same address.

Gas Detecting Apparatus

► GAS DETECTING apparatus, particularly to detect dangerous carbon monoxide being discharged into the cabin of an airplane and release an off-setting gas, brought Charles W. Klug, Chicago, patent 2,549,974. Rights are assigned to Stewart-Warner Corporation of the same city.

Detection is by means of a yellow gel developed by the National Bureau of Standards which turns to a dark blue-green color in the presence of carbon monoxide. The gel is in a suitable container through which the air of the cabin passes. The apparatus also contains a light source and a photosensitive device which impinges light passing through the sensitive gel to change the conductivity of the device.

The change in light passing through the gel as it changes in color activates the photoelectric device which in turn releases a gas to restore the gel to its original color. Ozone is one of the gases and the oxides of nitrogen are others having this restorative action. They react on the carbon monoxide.

Improved Paints

► IMPROVED exterior paints, subject for a patent, contain soybean oil as the principal oil ingredient but do not remain tacky as do earlier soybean paints. These new paints have also improved drying qualities, color retention and durability.

The inventors are Arthur J. Lewis, Helen A. Moser and John C. Cowan, all of Peoria, Ill. They received patent 2,550,703. Rights are assigned to the U.S. Government as represented by the Secretary of Agriculture.

The soybean oil used is cleared of extraneous matter. The use of calcium oxide is responsible for the improvements in the paints. The calcium

oxide is added as a pigment component in amounts from 4% to 10% by weight of the pigment. This small amount of calcium oxide is not sufficient to cause early paint-coating failure by cracking and checking.

Electroplating Metal On Rubber

➤ A SUCCESSFUL method of applying a layer of metal to rubber by an electroplating process brought patent 2,551,342 to Elwood L. Scholl of Detroit. Patent rights are assigned to the United States Rubber Company of New York City. A strong bond between the metal and the rubber is claimed.

Bonding metal to rubber is not new, but the processes used involve vulcanization of the rubber while in contact with the metal. In certain applications it is desirable to apply metal to rubber by electroplating. In electroplating the rubber is not vulcanized and in earlier processes a strong adhesion did not result.

In this new patented process the rubber is first treated with a solution of phosphorous trichloride, or certain other chemicals, and after drying given a coating of electrically-conductive graphite. It is then ready to receive a metal coating.

Vitamin-Coated Salt

➤ THE vitamins needed by the human being can now be taken at the dining table as a coating on the grains of ordinary table salt. This vitamin-coated salt, is designed to make up for the vitamins lost in cooking of vegetables. Vitamins taken with the salt are claimed to be more effective than those taken in pills because they are thoroughly mixed with the food in a

natural manner. Patent 2,550,726 was awarded Merton A. Searle, St. Paul, Minn., for the invention.

Titanium-Aluminum-Molybdenum Alloys

➤ WIDER use of the metal titanium in structural work is promised with an alloy possessing strength, ductility, hardness and elastic properties on which a patent has been issued. It contains 90% titanium. The other metals are aluminum and molybdenum in varying proportions.

Titanium ore is very plentiful. Compounds of this metal are in wide usage, particularly the oxide used as a white pigment in paint. In recent years, commercial methods of obtaining the metal itself from its ores have developed and titanium is becoming more common. It has many practical applications but for some structural purposes needs additional strength and ductility.

Patent 2,554,031 was issued to Robert I. Jaffee and Horace R. Ogden, both of Columbus, Ohio, for this alloy. Remington Arms Company, Inc., Bridgeport, Conn., has acquired the patent rights.

Two-Film Camera

➤ A TWO-FILMED camera, on which Clarence C. Smith of Flushing, N.Y., received patent 2,554,349, can be loaded with a color film and an ordinary film at the same time so that pictures may be taken in color or black-and-white at the choice of the photographer.

The film holder of the camera, which is attached in a similar manner as the usual film pack holder, holds the two films with their photosensitive surfaces facing outward. The holder

is merely reversed in position to change from one film to the other. Safety slides are provided for protecting the two films from light prior to exposure in the camera.

Improved Impregnation Process

► FLUID compositions are forced into the innermost cells in porous material by a combination of a vacuum impregnation process with heat in an invention which brought patent 2,554,254 to Herbert M. Kroft, Baltimore, Md. Patent rights are assigned to Westinghouse Electric Corporation, East Pittsburgh, Pa. The process is particularly suitable in thoroughly saturating the fibrous insulation in electric coils with an insulating varnish.

In this process, as in other vacuum processes the coils are placed in a chamber and the air, moisture and other volatiles removed, even from the tiny spaces within them. Then they are flooded with the insulating varnish and high pressure applied to drive the material into interior cells. In this new process, infra-red radiation supplies a temperature during the process of about 80 degrees Centigrade. The result is a complete impregnation.

Borax As Tracer

► A METHOD of tracing the underground flow of water should be of particular value in the oil industry where water pressure is being used to get secondary production of petroleum. In this procedure water is forced down a central drill hole to drive the underground crude oil through the sands to the wells under pumps.

The injected water used in this process contains borax. Very tiny traces of this boron chemical that pass from the injection well to a producing well

can be detected by spectrographic analysis. A suitable chemical for this purpose has been long sought by oilmen. Borax, the inventors of this process claim, is the only substance yet found that answers the full requirements as a satisfactory tracing material for this particular application. Patent 2,553,900 was issued to Richard L. Doan and Edwin Fast, Bartlesville, Okla., for this process. Rights have been assigned to Phillips Petroleum Company of the same city.

Razor Blades of Glass

► RAZOR BLADES made of glass, designed to replace the ordinary steel type, are produced by a method on which the government has issued a patent. The keen cutting edge on the glass blade is made by grinding followed by treatments in an etching bath.

The blanks from which the blades are made are similar in size, thickness and quality of glass to high quality microscope slides. It has been found, the inventors claim, that glass blades of superior keenness and edge-holding quality can be produced economically by their process.

It includes grinding on a relatively rough stone, rotating away from the edge, and then subjecting the edge to a series of short dips in an etching bath, following each dip with rinsing or cleansing. The etching bath contains hydrofluoric acid.

Inventors are Irving D. Wallach, Port Washington, and Emil C. Joost, Springfield Gardens, N.Y. They received patent 2,555,214. Rights have been assigned to Associated Development and Research Corporation of New York City.

Rechargeable Electric Cell

► AN IMPROVED rechargeable electric cell, for uses ranging from hearing aids to radio transmitters, brought patent 2,554,504 to Samuel Ruben, New Rochelle, N.Y. It is a secondary cell, claimed to be capable of being charged and discharged a large number of times without appreciable loss of its current storage capacity or overall efficiency.

A feature of this cell is the use of silver in a powder form mixed with an oxide of mercury for the positive electrode, the silver reducing the electrical resistance of the mercury oxide and eliminating the danger of coalesced mercury particles. The negative electrode essentially comprises zinc together with mercury as its active ingredient, the mercury being present in the form of zinc amalgam. The electrolyte is an aqueous solution of an alkali metal hydroxide, such as potassium hydroxide, initially containing a substantial quantity of alkali metal zincate, such as potassium zincate.

Alcohol Injector

► MORE power for the automobile engine for high speeds and hill-climbing is provided with an improved alcohol-water injection device which automatically supplies the mixture at a rate which increases proportionately to the engine speed. Inventors are Philip H. Bills, Longmeadow, Joseph A. Logan, Hadley, and Theodore J. Mesh, Easthampton, Mass. Gilbert and Barker Manufacturing Company, West Springfield, Mass., has acquired the patent rights.

It is well known that a mixture of water and alcohol will result in better performance of an internal-combus-

tion engine, the inventors state. At ordinary legal speeds on level roads, regular gasoline gives satisfactory power. This invention is to provide the injection when higher speeds are desirable or satisfactory power for hill-climbing without engine knock.

The injection is made by a pump which is controlled by a switch actuated by the suction of the engine manifold. This results in injection during the periods when the engine is working hard. The circuit breaker of the ignition system of the engine is used as a vibrator to convert the current from the storage battery to the high frequency pulsating current needed to operate the pump.

New Packaging Methods

► DEHYDRATED soups and desserts, natural and imitation fruit flavorings, dried eggs and milk, soluble coffee, and other dehydrated products will keep their flavors locked in and stay in shape to use without airtight packaging through use of two new methods which won five patents for two scientists of Parke, Davis and Company, Detroit.

The methods involve mixing the food and beverage products with either polyvinyl alcohol or a cellulose derivative. They are now being tested by the manufacturers of various food products, but are not yet in general use.

Many extracts of natural and synthetic flavors lose some of their original flavor or odor or both when they are stored. In addition, they tend to become caked from the moisture in the atmosphere. The fatty substances in dried soups now have to be packed

expensively and usually separate from the other ingredients.

If these two chemicals are mixed with the dehydrated foods and drinks, the patent descriptions claim, this deterioration and the expensive airtight packaging which is needed to prevent it are done away with.

Patents 2,555,464 through 2,555,468 were issued to Herman H. Bogin and Rufus D. Feick and assigned by them to Parke, Davis and Company, Detroit, on the new methods.

New Titanium Processing

► **NEW METHODS** for purifying and chlorinating titanium, important and strategic metal, used mostly in airplane metal alloys, received patents 2,555,361 and 2,555,374. Both assigned to the National Lead Company, New York, the first was received by Walter K. Nelson and Helmut Espenschied and the second by Lancelot W. Rowe and Sanford S. Cole. All four inventors are from Metuchen, N.J.

Finely divided titanium can be chlorinated under the new system, according to the inventors. Titanium oxide and chloride are passed through a restraining bed of lesser reactivity than the titanium oxide. By the other method, crude titanium tetrachloride, usually too impure for use, can be purified through reducing the vanadium content. This is done by a process of mixing titanium tetrachloride with a lead base substance and distilling the mixture.

NaNO₃ For Explosives

► **SODIUM NITRATE**, important chemical used in making explosives and for many other purposes, is made from sodium carbonate or bicarbonate by

an improved process which brought Leonard A. Stengel, Terre Haute, Ind., patent 2,535,990.

The success of the process is due to the temperature used. The nitration of the sodium carbonate or bicarbonate is found to proceed rapidly if the materials are treated with nitrating agents at a temperature at or above the melting point of the corresponding nitrate. Also, under such reaction conditions the resulting sodium nitrate can be removed from the reactor chamber in a molten condition.

In the process, the preferred nitrating agent is vaporized nitric acid of a concentrated strength of from 50% to 65%. Reactor temperature is up to 600 degrees Centigrade. Patent rights have been assigned to Commercial Solvents Corporation, Terre Haute.

Rapid Wood Curing

► **EMERGENCY** needs for dry lumber can be met by a process which utilizes an alternating cycle of vapor drying and vacuum and produces cured wood without interior checking as in the ordinary vapor curing method.

In the process the wood is put in an enclosed chamber with a highly heated organic vapor that is inert to the wood. This causes moisture in the wood to flash-off as vapor. With this process alone, internal checking is induced in some types of wood. In the new process, one hour of vapor drying is followed by one hour of vacuum drying. The alternation is continued until the desired degree of drying is obtained.

Patent number for this process is 2,535,925. The recipient is Monie S. Hudson, Spartanburg, S. C.

For the Home Lab

Sulfur Dioxide

by BURTON L. HAWK

► I SHALL NEVER forget my first contact with sulfur dioxide. It seems that the electric refrigerator developed a leak. At first we did not pay too much attention when the pungent odor drifted from the refrigerator, but as it rapidly became more pungent and more concentrated, our fears also became more pungent and more concentrated. Of course, in those days of blissful ignorance, we did not know that the gas was the harmless sulfur dioxide. All we could think of was some dreadful poisonous concoction and with smarting eyes, running noses, and burning throats, we frantically called the repairman. Feeling that freezing was preferable to suffocation, we opened all of the windows and waited. When the repairman finally arrived, he calmly assured us that the gas was relatively harmless and that we would live through it. With our smarting eyes, running noses, and burning throats, we did not entirely agree with him.

It Is Prepared Easily

In the home lab, sulfur dioxide is most conveniently prepared by the action of dilute acids on sodium bisulfite. In a large flask, place 2 or 3 grams of sodium bisulfite and cover the solid with about $\frac{1}{4}$ inch of water. Fit a 2-hole stopper to the flask containing a thistle tube and delivery tube. Be sure the thistle tube extends beneath the surface of the liquid in the flask. When you are ready to gen-

erate sulfur dioxide, simply pour dilute hydrochloric acid, in small quantities, through the thistle tube.

It Will Dissolve In Water

Arrange your delivery tube from the generator so that the gas will bubble through water in a test tube. It will dissolve readily forming a solution of sulfurous acid, H_2SO_3 . The acidic properties can be identified with litmus paper.

It Will De-Colorize

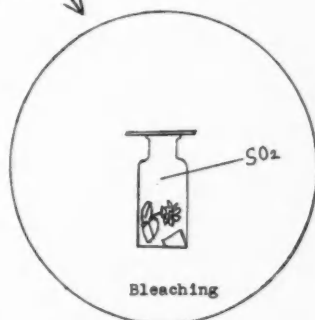
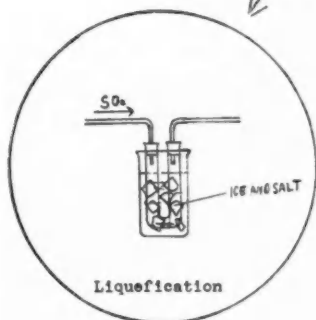
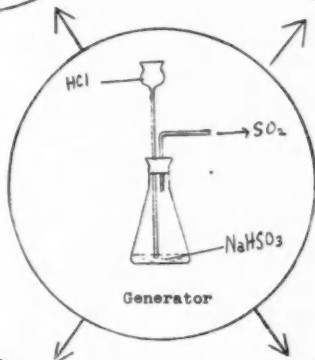
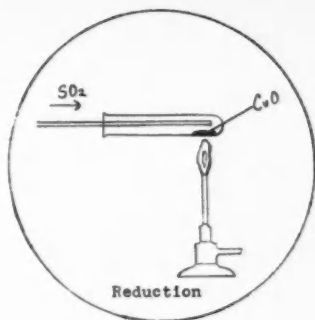
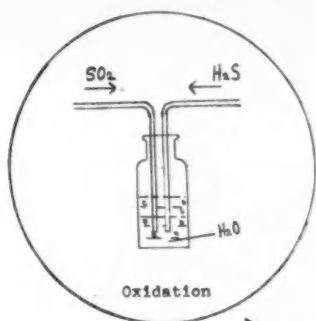
Bubble the gas through a dilute solution of potassium permanganate. As each bubble enters the solution, the violet color fades slightly until the solution is entirely colorless.

It Can Be Liquefied

Sulfur can be liquefied very easily at atmospheric pressure with salt and ice mixture. Insert a U-tube in a container filled with crushed ice and salt. Attach the delivery tube of your SO_2 generator to the U-tube and allow the gas to pass through. Soon you will note a colorless liquid forming in the bottom of the U-tube. This is liquid sulfur dioxide. Remove the tube from the ice and you will observe that the liquid gradually boils away.

It Will Bleach

Fill a large jar with sulfur dioxide. Moisten a few bits of colored paper, cloth, flowers, leaves, etc. and place in the jar. Cover with a glass plate and let stand for a while. Sulfur dioxide will bleach many items (but not



► VERSATILE sulfur dioxide plays many roles in the home laboratory theater.

everything), especially silk, wool, straw and flowers, although in most cases the bleaching is not permanent.

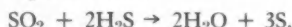
It Will Preserve

Place half of a freshly cut red apple in a jar of sulfur dioxide. Take notice that the brown discoloration that usually takes place in air does not occur in an atmosphere of sulfur dioxide, although the red skin will be bleached. Sulfur dioxide has been used as a preservative in many foods; however, its use in this category has been questioned and is still open to argument.

Incidentally, if you want to restore the red color to your apple, rub the skin with hydrogen peroxide. But don't eat it!

It Will Oxidize

Sulfur dioxide is not generally known as an oxidizing agent, but it will oxidize hydrogen sulfide, producing free sulfur:



You can demonstrate this reaction by bubbling sulfur dioxide through an aqueous solution of hydrogen sulfide. Or, if you wish, bubble both sulfur dioxide and hydrogen sulfide through water simultaneously. The hydrogen sulfide is prepared by adding dilute hydrochloric acid to iron sulfide.

It Will Reduce

Sulfur dioxide is better known as an active reducing agent. For example, it will reduce the oxides of many metals. Place a small quantity of cupric oxide in a dry test tube. With the tube in a horizontal position, apply heat and allow sulfur dioxide to flow over the heated powder for a few minutes. Then remove and examine closely. Can you find any trace of metallic copper?

And It Will Affect You

Are your eyes smarting? Nose running? Throat burning? If so, you've had enough for a while. So, let's get some fresh air and call it a day.

Round Grains Make Grease Smoother

► **MICROSCOPIC** ball-bearings in the grease will make your car run more smoothly.

Round particles which make lubricating grease smoother and slipperier have been made out of silica, which usually comes as sharp edged grains of sand. Du Pont chemists blend these tiny spheres with lubricants which ordinarily grow thin when machinery gets hot. Grease so treated stays put

and does not leak out of the machine as temperature goes up.

The round, fine-grained form of silica was found by chemists trying to see how many kinds of things they could make out of sand. Although always underfoot, this material still holds surprises. The idea of putting it into lubricants came after it had been made and its smooth, slippery nature recognized.

New Process Promises Metal At \$1 Instead of \$5 a Pound

Lower-Cost Titanium Metal

► STEP BY STEP, the metal titanium is coming into its own. With new processes for reducing it from its plentiful ores, this structural metal is passing out of the list of the "little-knowns" into the list of "common" metals to take its place side by side with steel and aluminum.

Titanium as a common metal is passing through stages of production and applications similar to those in the history of aluminum. Both of these metals were long known before they could be produced economically by commercial processes. During World War II, the U.S. Bureau of Mines developed a method of obtaining relatively pure titanium at a reasonable cost but not low enough for general commercial production.

Since then improved processes have been developed by other agencies, both public and private. Among them is the Office of Naval Research, backed by the certainty that this metal and its

alloys can serve many useful purposes in naval construction.

After several years of work by Naval Research, it is now announced that a process has been developed by which the metal can be obtained at about one-fifth of present costs. This means titanium at \$1 a pound instead of the present \$5-a-pound cost. The new process was developed by Horizons, Inc., Cleveland, Ohio. Pilot-plant stages in production have been reached.

Titanium is a light, strong, corrosion-resistant metal. In weight it is between steel and aluminum, being about 70% heavier than the latter. It is a structural metal, as strong as steel. Extensive uses are predicted in airplanes and in ship construction. Its principal uses will probably be in alloys. The Navy has already achieved a titanium-aluminum-chromium alloy which is expected to have extensive applications in jet aircraft.

Foods Packed in Nitrogen

► PACKAGING in nitrogen instead of oxygen of the air will keep such foods as potato chips, roasted nuts, dry soup mixes and dehydrated foods, packed in flexible film, fresh for much longer than is now possible.

"Same-day" freshness for foods packed months or even a year before their purchase is promised by W. S. Walker of the Linde Air Products

Company. Benefits from using nitrogen to protect food products against oxygen deterioration have been proved for many foods.

Nitrogen is harmless and tasteless and does not change the natural flavor and color of the food. Shelf life and quality of film-packed foods are improved significantly by processing and packaging in nitrogen.

Polymerization Caused By Cathode Ray Bombardment

Solid Plastics Made from Liquid

►CATHODE RAYS, or beams of electrons, similar to those used in television receivers, can convert liquid raw materials into solid plastics.

In the manufacture of plastics, through polymerization, small groups of atoms are linked together to form long chains. The individual groups can move around freely, so that they form a liquid. The chains make a rigid, solid structure.

Generally, chemical means are used to initiate the polymerization. When once started, this proceeds rapidly in a chain reaction. Such polymerization is being successfully achieved by Dr. John V. Schmitz and Elliott J. Lawton of the General Electric with a beam of electrons with energies of 800,000 volts obtained from a modified million-volt X-ray machine.

The basis of this present work is

success obtained 25 years ago by Dr. William D. Coolidge, former director of the G.E. research laboratory, in which he converted castor oil into a solid with X-ray bombardment. Other compounds, such as ethylene, were similarly polymerized.

The joining together of the individual molecular units to form the long chains, or polymers, results from a rearrangement in the electrons in the atoms. Ordinarily they are rearranged by chemical action. The same effect is obtained by firing other electrons, with high speed, at the liquid made of the separate units. These hit a few of the atoms, either knocking their electrons out, or else sticking and increasing their number. With a small porportion of the atoms thus altered, the reaction starts and proceeds through the volume of liquid exposed to the rays.

Rubber-Fabric Drums

►RUBBER-FABRIC drums, suitable for replacing metal drums now widely used in shipping liquids, have been developed by the United States Rubber Company. They have capacity for 55 gallons, and after shipping can be returned for reuse.

When empty they collapse. Some 2,500 of the collapsed drums can be shipped in a single box car that would hold only 300 of the common

metal drums. This means a great saving in freight costs.

These rubber drums are suitable for the shipment of petroleum products, oils, greases, fats, acids, paints, emulsions, soaps, dry powders and a variety of pharmaceutical and industrial chemicals. They are tough, light in weight, easy to lift, roll, handle and stow. They are made of material that is non-corrosive, non-absorbent and resistant to weathering.

**Dr. Williams, B₁ Synthesizer,
Advocates Adding Vitamin to Rice**

Enriched Rice Saves Lives

►Dr. ROBERT R. WILLIAMS, who achieved the synthesis of vitamin B₁, has made a trip around the world visiting great rice producing countries of the world in the interest of making that great food staple a better food for the millions upon millions of people who rely primarily upon rice as their foodstuff.

As the rice eating races of the world have concentrated more largely in cities and gotten away from the hand-pounding of rice that used to be practiced, now nutritional and deficiency diseases have increased as more refined food is eaten. When rice is milled nutrients are lost so that beri-beri is still a great killer of mankind, although it is known that this disease is prevented by vitamin B₁. Production of white rice is necessary for far away markets in order that the rice may keep and be stored. The vitamin content can be restored to the rice by the process that Dr. Williams advocates. This involves treating only about a half pound of rice out of every hundred that is sold, restoring to these relatively few grains the necessary vitamins synthetically and then mixing them when the rice is sold to the people for food. This method has been given a long term test in Bataan, Phil-

ippines where vitamin enriched rice has been used for over two years and a cessation of deaths due to beri-beri has occurred whereas deaths from this deficiency disease were very prevalent in the past. Enriched rice looks and tastes like ordinary rice and costs only about 1 per cent more.

One of the problems in connection with introducing enriched rice in India, Burma, China, Java and Japan and other areas where beri-beri is prevalent is the introduction of the necessary synthetic vitamins into these areas under present conditions of foreign exchange. Although the amount of synthetic vitamins is very small, relatively speaking, they can most effectively be produced in western countries and the problem of the eastern areas is to find the necessary American money to buy it.

Dr. Williams is an executive of the Research Corporation and he is a member of the Baptist Board of Foreign Missions. He has conducted his present introduction of enriched rice under the auspices of the Williams-Waterman Fund for combat of dietary disease, a fund which he and his associates set up by assigning to it their vitamin B₁ patents.

Western pines, like southern pines which produce naval stores, may become a source of chemicals such as certain soluble carbohydrates, tannin, natural pigments, fats, fatty acids, resin acids, sterols, waxes, and hydrocarbons.

Proudly Presented

► **LABORATORY WORKERS** will find compact test kits and convenient containers offered in the 13th edition of "What's New for the Laboratory," published by the Scientific Glass Apparatus Co., 100 Lakewood Terrace, Bloomfield, N. J.

► **NITROSYL CHLORIDE** is the subject of an 80-page book available to companies interested in this unusual chemical. Write on company stationery to The Solvay Process Division, Product Development Dept., Room 1001, 40 Rec-tor St., New York 6, N. Y.

► **GOSSYPOL PIGMENTS** in cotton seed may be determined by new speedier and more accurate tests developed at the Southern Regional Research Laboratory of the U.S. Department of Agriculture's Bureau of Agricultural and Industrial Chemistry, New Orleans, La.

► **KIMBLE FLAT-BOTTOMED GLASS TUBES** for Nessler color comparison tests are offered with interchangeably-ground cap stoppers in three sizes, in both standard and low forms. The announcement comes from the public relations department of Owens-Illinois Glass Co., Box 1935, Toledo 1, Ohio, in behalf of their Kimble Glass Division.

► **TITANIUM** is to be manufactured on a large scale for the first time in a \$14-million plant at Henderson, Nev. The contract for the plant has been awarded to the H. K. Ferguson Co. by Titanium Metals Corp. of America, jointly owned by National Lead Co.

and Alleghany-Ludlum Steel Corp. Production of 3600 tons annually is expected by the latter part of 1952.

► **FLAME-RESISTANT** cellulose molding powder and other similar molding powders for specialized uses are offered under the trade name Herocel by the Hercules Powder Co., Wilmington, Del., which also makes available industrial design service to foster the development of better designed plastics products.

► **CARBON CONTROL** by means of two quick tests is offered by Dietert-Detroit equipment from the Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.

► **CROTONIC ACID:** $\text{CH}_3\text{CH}=\text{CH}\cdot\text{COOH}$ is being marketed in commercial quantities by Eastman Industrial Chemicals for use in preparation of lacquer solvents, insecticides, vitamins and other organic syntheses. A bulletin containing a bibliography of technical literature on this new chemical is available from Tennessee Eastman Corp., Kingsport, Tenn.

► **THE DOW CHEMICAL CO.**, Midland, Michigan, announces its Technical Data Bulletin, Alpha Methylstyrene. Part of the information contained in it was contributed to the American Chemical Society's new monograph "Styrene", but further technical data are included in the bulletin, which chemists working with this material and its copolymers will find a valuable addition to their working library.

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